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(54) Title: COMPOSITIONS OF A FLUOROETHER AND A HYDROFLUOROCARBON

(57) Abstract

This invention relates to compositions that include at least one fluoroether and at least one hydrofluorocarbon. Included in this invention are compositions of a cyclic or acyclic hydrofluoroether of the fomula $C_aF_bH_{2a+2-b}O_c$ wherein $a=2$ or 3 and $3 \leq b \leq 8$ and $c=1$ or 2 and a hydrofluorocarbon of the formula $C_nF_mH_{2n+2-m}$ wherein $1 \leq n \leq 4$ and $1 \leq m \leq 8$. Such compositions may be used as refrigerants, cleaning agents, expansion agents for polyolefins and polyurethanes, aerosol propellants, heat transfer media, gaseous dielectrics, fire extinguishing agents, power cycle working fluids, polymerization media, particulate removal fluids, carrier fluids, buffing abrasive agents, and displacement drying agents.

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TITLE

COMPOSITIONS OF A FLUOROETHER AND A HYDROFLUOROCARBON

FIELD OF THE INVENTION

This invention relates to compositions that include at least one fluoroether and at least one hydrofluorocarbon. Such compositions may be used as refrigerants, cleaning agents, expansion agents for polyolefins and polyurethanes, aerosol propellants, heat transfer media, gaseous dielectrics, fire extinguishing agents, power cycle working fluids, polymerization media, particulate removal fluids, carrier fluids, buffing abrasive agents, displacement drying agents and as carriers for sterilant gases.

Included in this invention are compositions which include a fluoroether and a hydrofluorocarbon in which the halocarbon global warming potential (HGWP) of the hydrofluorocarbon is lowered by adding the fluoroether to the hydrofluorocarbon. Also included in this invention are compositions a fluoroether and a hydrofluorocarbon that are azeotropic or azeotrope-like.

BACKGROUND OF THE INVENTION

Fluorinated hydrocarbons have many uses, one of which is as a refrigerant. Such refrigerants include dichlorodifluoromethane (CFC-12) and chlorodifluoromethane (HCFC-22).

In recent years it has been suggested that certain chlorofluorocarbon (CFC) and hydrochlorofluorocarbon (HCFC) refrigerants released into the atmosphere may adversely affect the ozone layer. Although this proposition has not yet been completely established, there is a movement toward the control of the use and the production of certain CFCs and HCFCs under an international agreement.

In order to address the potential problem of ozone depletion, it has been suggested that chlorofluorocarbon refrigerants and hydrochlorofluorocarbon refrigerants be replaced with hydrofluorocarbon refrigerants. Since the hydrofluorocarbon (HFC) refrigerants contain no chlorine, they have zero ozone depletion potential.

Another environmental concern is the role of CFCs in the "greenhouse effect". The greenhouse effect refers to the warming of the Earth's climate that takes place when atmospheric gases, which are relatively transparent to visible light and allow sunshine to reach the Earth, trap heat by absorbing infrared radiation released by the Earth.

There is presently no universally accepted methodology for combining all relevant factors into a singe global warming potential for emissions of gases such as CFCs. One approach is to define the greenhouse effect of a compound in terms of a potential to enhance global warming relative to a known standard. One such definition is known as a halocarbon global warming potential (HGWP), which is the ratio of incremental radiative warming resulting from an emission of a gas, over the lifetime of the gas in the atmosphere, to the calculated warming that would result from a release of the same mass of reference gas CFC-11.

While HFCs may have a zero ozone depletion potential, some HFCs may have an HGWP that may be undesirable and subject to governmental regulation. Accordingly, there is also a demand for the development of refrigerants that have a low ozone depletion potential while at the same time having a low HGWP.

It is preferred that refrigerants that include more than one component be azeotropic or azeotrope-like so that the composition of the refrigerant does not change when leaked or discharged to the atmosphere from refrigeration equipment. A change in composition of a refrigerant may affect its properties, such as performance or flammability.

It is also desirable to use compositions that have a low ozone depletion potential and/or a low HGWP and/or that are azeotropic or azeotrope-like as cleaning agents, blowing agents in the manufacture of closed-cell polyurethane, phenolic and thermoplastic foams, as propellants in aerosols, as heat transfer media, gaseous dielectrics, fire extinguishing agents, power cycle working fluids, such as for heat pumps, inert media for polymerization reactions, fluids for removing particulates from metal surfaces, as carrier fluids that may be used, for example, to place a fine film of lubricant on metal parts, or as buffing abrasive agents to remove buffing abrasive compounds from surfaces such as metal, as displacement drying agents for removing water, such as from jewelry or metal parts, as resist developers in conventional circuit manufacturing techniques including chlorine-type developing agents, and as strippers for photoresists when used with, for example, a chlorohydrocarbon, such as 1,1,1-trichloroethane or trichloroethylene.

SUMMARY OF THE INVENTION

This invention relates to compositions that include a fluoroether and a hydrofluorocarbon. Included in this invention are compositions of a cyclic or acyclic hydrofluoroether of the formula $C_aF_bH_{2a+2-b}O_c$ wherein a=2 or 3 and $3 \leq b \leq 8$ and c=1 or 2 and a hydrofluorocarbon of the formula $C_nF_mH_{2n+2-m}$ wherein $1 \leq n \leq 4$ and $1 \leq m \leq 8$. Such compositions may be used as refrigerants, cleaning agents, expansion agents for polyolefins and polyurethanes, aerosol propellants, heat transfer media, gaseous dielectrics, fire extinguishing agents, power cycle working fluids, polymerization media, particulate removal fluids, carrier fluids, buffing abrasive agents, and displacement drying agents.

Another aspect of this invention relates to the discovery that the HGWP of a hydrofluorocarbon can be lowered by adding to the hydrofluorocarbon a fluoroether having a lower HGWP than the HGWP of the hydrofluorocarbon. Accordingly, the present invention relates to a composition of a first component that includes a hydrofluorocarbon and a second component that includes a fluoroether that has an HGWP less than the HGWP of the first component, such that the HGWP of the composition is less than the HGWP of the first component.

Also included in this invention are compositions which include a fluoroether and a hydrofluorocarbon that are azeotropic or azeotrope-like.

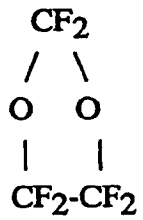
DETAILED DESCRIPTION

The present invention relates to compositions that include a fluoroether and a hydrofluorocarbon (HFC). Included in this invention are compositions of a cyclic or acyclic hydrofluoroether of the formula $C_aF_bH_{2a+2-b}O_c$ wherein a=2 or 3 and $3 \leq b \leq 8$ and c=1 or 2 and a hydrofluorocarbon of the formula $C_nF_mH_{2n+2-m}$ wherein $1 \leq n \leq 4$ and $1 \leq m \leq 8$. These compositions may be used as refrigerants, cleaning agents, expansion agents for polyolefins and polyurethanes, aerosol propellants, heat transfer media, gaseous dielectrics, fire extinguishing agents, power cycle working fluids, polymerization media, particulate removal fluids, carrier fluids, buffing abrasive agents, and displacement drying agents.

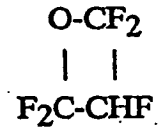
The fluoroethers that are included in this invention have two or three carbon atoms. Examples of such fluoroethers include the following.

1. Hexafluorodimethyl ether (116E, or CF_3OCF_3, boiling point = -59.0°C),
2. Pentafluorodimethyl ether (125E, or CHF_2OCF_3, boiling point = -36.2°C),

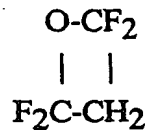
3. Bis(difluoromethyl) ether (134E, or CHF_2OCHF_2, boiling point = 5°C),
4. Fluoromethyl trifluoromethyl ether (134aE, or CH_2FOCF_3, boiling point = -20.0°C),
5. Trifluoromethyl methyl ether (143aE, or CH_3OCF_3, boiling point = -24.2°C),
6. Perfluorooxetane (C-216E or CF_2O | | CF_2CF_2, boiling point = -29.2°C),
7. 2,2,4,4,5,5-hexafluoro-1,3-dioxolane (C-216E2 or $C_3F_6O_2$, having a structure of



boiling point = -22.1°C),
8. Perfluoromethyl ethyl ether (218E, or $CF_3OCF_2CF_3$, boiling point = -23.3°C),
9. Perfluorodimethoxymethane (218E2, or $CF_3OCF_2OCF_3$, boiling point = -10.2°C),
10. 2,2,3,4,4-pentafluorooxetane (C-225eE$\alpha\beta$, or C_3HF_5O, having a structure of

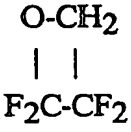


boiling point = 3.4°C),
11. 1-trifluoromethoxy-1,1,2,2-tetrafluoroethane (227caE$\alpha\beta$, or $CF_3OCF_2CHF_2$, boiling point = about -3°C),
12. Difluoromethoxy pentafluoroethane (227caE$\beta\gamma$, or $CHF_2OCF_2CF_3$, boiling point = -8.0°C),
13. 1-trifluoromethoxy-1,2,2,2-tetrafluoroethane (227eaE, or $CF_3OCHFCF_3$, boiling point = -9.4°C),
14. 2,2,4,4-tetrafluorooxetane (C-234fE$\alpha\beta$, or $C_3H_2F_4O$, having a structure of



boiling point = 21.2°C),

15. 2,2,3,3-tetrafluorooxetane (C-234fEβγ, or $C_3H_2F_4O$, having a structure of



boiling point =28°C),

16. 1-difluoromethoxy-1,1,2,2-tetrafluoroethane (236caE, or $CHF_2OCF_2CHF_2$, boiling point = 28.5°C),

17. 1-difluoromethoxy-1,2,2,2-tetrafluoroethane (236eaEβγ, or $CHF_2OCHFCF_3$, boiling point = 23.2°C),

18. 1-trifluoromethoxy-2,2,2-trifluoroethane (236faE, or $CF_3OCH_2CF_3$, boiling point = 5.6°C),

19. 1-difluoromethoxy-2,2,2-trifluoroethane (245faEβγ, or $CHF_2OCH_2CF_3$, boiling point = 29°C).

116E (CAS Reg. No. 1479-49-8) has been prepared by electrochemical fluorination of dimethyl ether as disclosed by Simons in U. S. Patent 2,519,983.

125E (CAS Reg. No. 3822-68-2) has been prepared by electrochemical fluorination of dimethyl ether (CH_3OCH_3) as disclosed by Fox, et. al. in U. S. Patent 3,511,760 and by Hutchinson in U. S. Patent 3,887,439.

134E (CAS Reg. No. 1691-17-4) can be prepared by reaction of antimony trifluoride with CHF_2OCHCl_2 as disclosed by O'Neill in GB 2,248,617.

134aE (CAS Reg. No. 2261-01-0) has been made by the electrochemical fluorination of methyl 2-methoxypropionate as reported by Berenblit, et. al. Zh. Org. Khim., Vol. 12, pp. 767-770 (1976).

143aE (CAS Reg. No. 421-14-7) has been made by the reaction of methyl fluoroformate with sulfur tetrafluoride as reported by Aldrich and Sheppard, J. Am. Chem. Soc., Vol. 29, 11-15 (1964).

C-216E (CAS Reg. No. 425-82-1) can be made by electrochemical

fluorination of trimethylene oxide (oxetane) in anhydrous hydrogen fluoride as disclosed by Kauck and Simons in U. S. Patent 2,594,272.

C-216E2 (CAS Reg. No. 21297-65-4) has been prepared by UV irradiation of perfluoro-b-oxa-d-valerolactone in the vapor or liquid phase as reported by Throckmorton in J. Org. Chem., Vol. 34, pp. 3438-3440 (1969). The lactone was prepared by the reaction of KF with perfluorooxydiacetyl chloride.

218E (CAS Reg. No. 665-16-7) has been made by direct fluorination of $CF_3OCH_2CF_3$ (prepared by reaction of CF_3OF with vinylidene fluoride) as reported by Sekiya and Ueda in Chemistry Letters, pp. 609-612 (1990).

218E2 (CAS Reg. No. 53772-78-4) was made in the electrochemical fluorination of methyl 2-methoxypropionate as reported by Berenblit, et. al. Zh. Org. Khim., Vol. 12, pp. 767-770 (1976).

C-225eE$\alpha\beta$ (CAS Reg. No. 144109-03-5) may be prepared by direct fluorination of trimethylene oxide (cyclo-$CH_2CH_2CH_2O$-) using techniques described by Lagow and Margrave in Progress in Inorganic Chemistry, Vol. 26, pp. 161-210 (1979) or by Adcock and Cherry in Ind. Eng. Chem. Res., Vol. 26, pp. 208-215 (1987). The direct fluorination is carried out to the desired level of fluorine incorporation into the starting material, and products receovered by fractional distillation.

227caE$\alpha\beta$ (CAS Reg. No. 2356-61-8) has been prepared by reacting difluoroacetyl fluoride with cesium fluoride and carbonyl fluoride followed by treatment with sulfur tetrafluoride as disclosed by Eisemann in U. S. Patent 3,362,190.

227caE$\beta\gamma$ (CAS Reg. No. 53997-64-1) has been made by electrochemical fluorination of $CHCl_2OCF_2CHClF$ as reported by Okazaki, et. al. J. Fluorine Chem., Vol. 4, pp. 387-397 (1974).

227eaE (CAS Reg. No. 2356-62-9) was prepared by reacting 2-trifluoromethoxy-tetrafluoropropionyl fluoride ($CF_3CF(OCF_3)COF$) with aqueous potassium hydroxide at 230°C as disclosed by Eisemann in U. S. Patent 3,362,190.

C-234fE$\alpha\beta$ may be prepared by direct fluorination of trimethylene oxide (cyclo-$CH_2CH_2CH_2O$-) using techniques described by Lagow and Margrave in Progress in Inorganic Chemistry, Vol. 26, pp. 161-210 (1979) or by Adcock and Cherry in Ind. Eng. Chem. Res., Vol. 26, pp. 208-215 (1987). The direct fluorination is carried out to the desired level of fluorine incorporation into the starting material, and products receovered by fractional distillation.

C-234fE$\beta\gamma$ (CAS Reg. No. 765-63-9) has been prepared by Weinmayr (J. Org. Chem., Vol. 28, pp. 492-494 (1963)) as a by-product from the reaction of

TFE with formaldehyde in HF.

236caE (CAS Reg. No. 32778-11-3) has been prepared by fluorination of $CHCl_2OCF_2CHF_2$ (prepared in turn by chlorination of $CH_3OCF_2CHF_2$) using anhydrous hydrogen fluoride with antimony pentachloride catalyst as reported by Terrell, et. al. in J. Medicinal Chem., Vol. 15, pp. 604-606 (1972).

236eaE$\beta\gamma$ (CAS Reg. No. 57041-67-5) has been prepared by chlorination of methoxy acetyl chloride to give the intermediate, $CHCl_2OCHClCOCl$, which was isolated and reacted with sulfur tetrafluoride at 150C to give the product as disclosed by Halpern and Robin in U. S. Patent 4,888,139.

236faE (CAS Reg. No. 20193-67-3) has been prepared by reaction of 2,2,2-trifluoroethanol with carbonyl fluoride to give the intermediate, CF_3CH_2OCOF, which was in turn reacted with sulfur tetrafluoride at 150-200°C to give the product as disclosed by Eisemann in U. S. Patent 3,394,878.

245faE$\beta\gamma$ (CAS Reg. No. 1885-48-9) has been prepared by the reaction of chlorodifluoromethane with trifluoroethanol in the presence of potassium hydroxide as disclosed by Croix in US Patent No. 3,637,477.

The HFCs that may be combined with the fluoroethers include one or more of the following: difluoromethane (HFC-32), fluoromethane (HFC-41), pentafluoroethane (HFC-125), 1,1,2,2-tetrafluoroethane (HFC-134), 1,1,1,2-tetrafluoroethane (HFC-134a), 1,1,2-trifluoroethane (HFC-143), 1,1,1-trifluoroethane (HFC-143a), 1,1-difluoroethane (HFC-152a), fluoroethane (HFC-161), 1,1,1,2,2,3,3-heptafluoropropane (HFC-227ca), 1,1,1,2,3,3,3-heptafluoropropane (HFC-227ea), 1,1,1,3,3,3-hexafluoro-propane (HFC-236fa), 1,1,2,2,3,3-hexafluoropropane (HFC-236ca), 1,1,1,2,2,3-hexafluoropropane (HFC-236cb), 1,1,2,2,3-pentafluoropropane (HFC-245ca), 1,1,1,2,2-pentafluoropropane (HFC-245cb), 1,1,2,3,3-pentafluoropropane (HFC-245ea), 1,1,1,3,3-pentafluoropropane (HFC-245fa), 1,2,2,3-tetrafluoropropane (HFC-254ca), 1,1,2,2-tetrafluoropropane (HFC-254cb), 1,1,1,2-tetrafluoropropane (HFC-254eb), 1,2,2-trifluoropropane (HFC-263ca), 1,1,1-trifluoropropane (HFC-263fb), 2,2-difluoropropane (HFC-272ca), 1,2-difluoropropane (HFC-272ea), 1,1-difluoropropane (HFC-272fb), 2-fluoropropane (HFC-281ea), 1-fluoropropane (HFC-281fa), 1,1,1,3,3,4,4,4-octafluorobutane (HFC-338mf), 1,1,1,4,4,4-hexafluorobutane (HFC-356mff), or $(CF_3)_2CHCH_3$, (HFC-356mmz).

The following can be used as refrigerants: compositions of a cyclic or acyclic hydrofluoroether of the formula $C_aF_bH_{2a+2-b}O_c$ wherein $a=2$ or 3 and $3 \leq b \leq 8$ and $c=1$ or 2 and a hydrofluorocarbon of the formula $C_nF_mH_{2n+2-m}$

wherein $1 \leq n \leq 4$ and $1 \leq m \leq 8$. Examples of such compositions include the following.

1-99 weight percent 116E and 1-99 weight percent HFC-32, HFC-41, HFC-125, HFC-134, HFC-134a, HFC-143, HFC-143a, HFC-152a, HFC-161 , HFC-227ca, HFC-227ea, HFC-236ca, HFC-236cb, HFC-236ea, HFC-236fa, HFC-245ca, HFC-245cb, HFC-245ea, HFC-245fa, HFC-254ca, HFC-254cb, HFC-254eb, HFC-263ca, HFC-263fb, HFC-272ca, HFC-272ea, HFC-272fb, HFC-281ea, or HFC-281fa.

1-99 weight percent 125E and 1-99 weight percent HFC-32, HFC-125, HFC-134, HFC-134a, HFC-143, HFC-143a, HFC-152a, HFC-161 , HFC-227ca, HFC-227ea, HFC-236ca, HFC-236cb, HFC-236fa, HFC-245ca, HFC-245cb, HFC-245ea, HFC-245fa, HFC-254ca, HFC-254cb, HFC-254eb, HFC-263ca, HFC-263fb, HFC-272ca, HFC-272ea, HFC-272fb, HFC-281ea, or HFC-281fa.

1-99 weight percent 134E and 1-99 weight percent HFC-32, HFC-125, HFC-134, HFC-134a, HFC-143, HFC-143a, HFC-152a, HFC-161 , HFC-227ca, HFC-227ea, HFC-236ca, HFC-236cb, HFC-236ea, HFC-236fa, HFC-245ca, HFC-245cb, HFC-245ea, HFC-245fa, HFC-254ca, HFC-254cb, HFC-254eb, HFC-263ca, HFC-263fb, HFC-272ca, HFC-272ea, HFC-272fb, HFC-281ea, HFC-281fa, HFC-338mf or 356mff.

1-99 weight percent 134aE and 1-99 weight percent HFC-32, HFC-125, HFC-134, HFC-134a, HFC-143, HFC-143a, HFC-152, HFC-152a, HFC-161 , HFC-227ca, HFC-227ea, HFC-236ca, HFC-236cb, HFC-236fa, HFC-245ca, HFC-245cb, HFC-245ea, HFC-245fa, HFC-254ca, HFC-254cb, HFC-254eb, HFC-263ca, HFC-263fb, HFC-272ca, HFC-272ea, HFC-272fb, HFC-281ea, or HFC-281fa.

1-99 weight percent 143aE and 1-99 weight percent HFC-32, HFC-125, HFC-134, HFC-134a, HFC-143, HFC-143a, HFC-152a, HFC-161 , HFC-227ca, HFC-227ea, HFC-236ca, HFC-236cb, HFC-236fa, HFC-245ca, HFC-245cb, HFC-245ea, HFC-245fa, HFC-254ca, HFC-254cb, HFC-254eb, HFC-263ca, HFC-263fb, HFC-272ca, HFC-272ea, HFC-272fb, HFC-281ea, or HFC-281fa.

1-99 weight percent C216E, and 1-99 weight percent HFC-32, HFC-125, HFC-134, HFC-134a, HFC-143, HFC-143a, HFC-152a, HFC-161 , HFC-227ca, HFC-227ea, HFC-236ca, HFC-236cb, HFC-236fa, HFC-245ca, HFC-245cb, HFC-245ea, HFC-245fa, HFC-254ca, HFC-254cb, HFC-254eb, HFC-263ca, HFC-263fb, HFC-272ca, HFC-272ea, HFC-272fb, HFC-281ea, or HFC-281fa.

1-99 weight percent C-216E2 and 1-99 weight percent HFC-32, HFC-134, HFC-134a, HFC-143, HFC-152a, HFC-161, or HFC-245cb.

1-99 weight percent 218E and 1-99 weight percent HFC-32, HFC-125,

HFC-134, HFC-134a, HFC-143, HFC-143a, HFC-152a, HFC-161 , HFC-227ca, HFC-227ea, HFC-236ca, HFC-236cb, HFC-236fa, HFC-245ca, HFC-245cb, HFC-245ea, HFC-245fa, HFC-254ca, HFC-254cb, HFC-254eb, HFC-263ca, HFC-263fb, HFC-272ca, HFC-272ea, HFC-272fb, HFC-281ea, or HFC-281fa.

1-99 weight percent 218E2 and 1-99 weight percent HFC-32, HFC-125, HFC-134, HFC-134a, HFC-143, HFC-143a, HFC-152a, HFC-161 , HFC-227ca, HFC-227ea, HFC-236ca, HFC-236cb, HFC-236fa, HFC-245ca, HFC-245cb, HFC-245ea, HFC-245fa, HFC-254ca, HFC-254cb, HFC-254eb, HFC-263ca, HFC-263fa, HFC-263fb, HFC-272ca, HFC-272ea, HFC-272fb, HFC-281ea, or HFC-281fa.

1-99 weight percent C-225eE$\alpha\beta$ and 1-99 weight percent HFC-143, HFC-236cb, HFC-236ea, or HFC-245cb.

1-99 weight percent 227caE$\alpha\beta$ and 1-99 weight percent HFC-32, HFC-125, HFC-134, HFC-134a, HFC-143, HFC-143a, HFC-152a, HFC-161 , HFC-227ca, HFC-227ea, HFC-236ca, HFC-236cb, HFC-236fa, HFC-245ca, HFC-245cb, HFC-245ea, HFC-245fa, HFC-254ca, HFC-254cb, HFC-254eb, HFC-263ca, HFC-263fb, HFC-272ca, HFC-272ea, HFC-272fb, HFC-281ea, or HFC-281fa.

1-99 weight percent 227caE$\beta\gamma$ and 1-99 weight percent HFC-32, HFC-125, HFC-134, HFC-134a, HFC-143, HFC-143a, HFC-152a, HFC-161 , HFC-227ca, HFC-227ea, HFC-236ca, HFC-236cb, HFC-236fa, HFC-245ca, HFC-245cb, HFC-245ea, HFC-245fa, HFC-254ca, HFC-254cb, HFC-254eb, HFC-263ca, HFC-263fb, HFC-272ca, HFC-272ea, HFC-272fb, HFC-281ea, or HFC-281fa.

1-99 weight percent 227eaE and 1-99 weight percent HFC-32, HFC-125, HFC-134, HFC-134a, HFC-143, HFC-143a, HFC-152a, HFC-161 , HFC-227ca, HFC-227ea, HFC-236ca, HFC-236cb, HFC-236fa, HFC-245ca, HFC-245cb, HFC-245ea, HFC-245fa, HFC-254ca, HFC-254cb, HFC-254eb, HFC-263ca, HFC-263fb, HFC-272ca, HFC-272ea, HFC-272fb, HFC-281ea, or HFC-281fa.

1-99 weight percent C-234fE$\alpha\beta$ and 1-99 weight percent HFC-245cb, HFC-245eb, HFC-356mff or HFC-356mmz.

1-99 weight percent C-234fE$\beta\gamma$ and 1-99 weight percent HFC-245ca, HFC-245cb, HFC-245ea, HFC-254ca, HFC-356mff or HFC-356mmz.

1-99 weight percent 236caE and 1-99 weight percent HFC-125, HFC-134, HFC-134a, HFC-143, HFC-143a, HFC-152a, HFC-161 , HFC-227ca, HFC-227ea, HFC-236ca, HFC-236cb, HFC-236fa, HFC-245ca, HFC-245cb, HFC-245ea, HFC-245fa, HFC-254ca, HFC-254cb, HFC-254eb, HFC-263ca, HFC-263fb, HFC-272ca, HFC-272ea, HFC-272fb, HFC-281ea, or HFC-281fa.

1-99 weight percent 236eaE$\beta\gamma$ and 1-99 weight percent HFC-125, HFC-134, HFC-134a, HFC-143, HFC-143a, HFC-152a, HFC-161 , HFC-227ca,

HFC-227ea, HFC-236ca, HFC-236cb, HFC-236fa, HFC-245ca, HFC-245cb, HFC-245ea, HFC-245fa, HFC-254ca, HFC-254cb, HFC-254eb, HFC-263ca, HFC-263fb, HFC-272ca, HFC-272ea, HFC-272fb, HFC-281ea, HFC-281fa, HFC-338mf, HFC-356mff or HFC-356mmz.

1-99 weight percent 236faE and 1-99 weight percent HFC-32, HFC-125, HFC-134, HFC-134a, HFC-143, HFC-143a, HFC-152a, HFC-161 , HFC-227ca, HFC-227ea, HFC-236ca, HFC-236cb, HFC-236fa, HFC-245ca, HFC-245cb, HFC-245ea, HFC-245fa, HFC-254ca, HFC-254cb, HFC-254eb, HFC-263ca, HFC-263fb, HFC-272ca, HFC-272ea, HFC-272fb, HFC-281ea, or HFC-281fa.

1-99 weight percent 245faE$\beta\gamma$ and 1-99 weight percent HFC-125, HFC-134, HFC-134a, HFC-143, HFC-143a, HFC-152a, HFC-161, HFC-227ca, HFC-227ea, HFC-236ca, HFC-236cb, HFC-236fa, HFC-245ca, HFC-245cb, HFC-245ea, HFC-245fa, HFC-254ca, HFC-254cb, HFC-254eb, HFC-263ca, HFC-263fb, HFC-272ca, HFC-272ea, HFC-272fb, HFC-281ea, HFC-281fa, or HFC-356mff.

The present invention also relates to the discovery of azeotropic or azeotrope-like compositions of effective amounts of the following compounds to form an azeotropic or azeotrope-like composition at a specific temperature or pressure:

116E and HFC-32, HFC-41, HFC-125, HFC-134, HFC-134a, HFC-143, HFC-143a, HFC-152a or HFC-161; 125E and HFC-32, HFC-134, HFC-134a, HFC-143, HFC-152a or HFC-161; 134E and HFC-143, HFC-227ca, HFC-227ea, HFC-236ca, HFC-236cb, HFC-236ea, HFC-236fa, HFC-245cb, HFC-254cb, HFC-254eb, HFC-338mf, or HFC-356mff; 134aE and HFC-32, HFC-134, HFC-143, HFC-152a, HFC-227ca, HFC-227ea or HFC-245cb; 143aE and HFC-32, HFC-134, HFC-143a, HFC-152a, HFC-227ca, HFC-227ea or HFC-245cb; C216E and HFC-134, HFC-134a, HFC-143, HFC-152a, HFC-161 or HFC-245cb; C216E2 and HFC-32, HFC-134, HFC-134a, HFC-143, HFC-152a, HFC-161 or HFC-245cb; 218E and HFC-134, HFC-134a, HFC-143, HFC-152a, HFC-161 or HFC-263fb; 218E2 and HFC-134, HFC-134a, HFC-143, HFC-152a, HFC-161, HFC-236fa or HFC-263fb; C-225eE$\alpha\beta$ and HFC-143, HFC-236cb, HFC-236ea or HFC-245cb; 227caE$\alpha\beta$ and HFC-32, HFC-143, HFC-245cb, HFC-272ca, HFC-281ea or HFC-281fa; 227caE$\beta\gamma$ and HFC-32, HFC-134, HFC-134a, HFC-143, HFC-152a, HFC-161, HFC-263fb, HFC-272ca, HFC-281ea or HFC-281fa; 227eaE and HFC-32, HFC-134, HFC-134a, HFC-143, HFC-152a, HFC-161, HFC-263fb, HFC-272ca, HFC-281ea or HFC-281fa; C-234fE$\alpha\beta$ and HFC-245cb, HFC-245eb, HFC-356mff or HFC-356mmz; C-234fE$\beta\gamma$ and HFC-245ca, HFC-245cb, HFC-245ea, HFC-254ca, HFC-356mff or HFC-356mmz; 236caE and HFC-143, HFC-245ca, or HFC-254ca; 236eaE$\beta\gamma$ and HFC-143, HFC-245ca, HFC-263ca, HFC-338mf, HFC-356mff or HFC-356mmz; or 236faE and HFC-32, HFC-143, HFC-272ca, HFC-272fb or HFC-281fa; 245faE$\beta\gamma$ and HFC-356mff.

By "azeotropic"composition is meant a constant boiling liquid admixture of two or more substances that behaves as a single substance. One way to characterize an azeotropic composition is that the vapor produced by partial evaporation or distillation of the liquid has the same composition as the liquid from which it was evaporated or distilled, that is, the admixture distills/refluxes without compositional change. Constant boiling compositions are characterized as azeotropic because they exhibit either a maximum or minimum boiling point, as compared with that of the non-azeotropic mixtures of the same components.

By "azeotrope-like" composition is meant a constant boiling, or substantially constant boiling, liquid admixture of two or more substances that behaves as a single substance. One way to characterize an azeotrope-like composition is that the vapor produced by partial evaporation or distillation of the liquid has substantially the same composition as the liquid from which it was evaporated or distilled, that is, the admixture distills/refluxes without substantial compositional change.

It is recognized in the art that a composition is azeotrope-like if, after 50 weight percent of the composition is removed such as by evaporation or boiling off, the difference in vapor pressure between the original composition and the composition remaining after 50 weight percent of the original composition has been removed is less than 10 percent, when measured in absolute units. By absolute units, it is meant measurements of pressure and, for example, psia, atmospheres, bars, torr, dynes per square centimeter, millimeters of mercury, inches of water and other equivalent terms well known in the art. If an azeotrope is present, there is no difference in vapor pressure between the original composition and composition remaining after 50 weight percent of the original composition has been removed.

Therefore, included in this invention are compositions of effective amounts of a fluoroether and an HFC such that after 50 weight percent of an original composition is evaporated or boiled off to produce a remaining composition, the difference in the vapor pressure between the original composition and the remaining composition is about 10 percent or less. Examples of such compositions include the following:

116E and HFC-32, HFC-41, HFC-125, HFC-134, HFC-134a, HFC-143, HFC-143a, HFC-152a or HFC-161; 125E and HFC-32, HFC-134, HFC-134a, HFC-143, HFC-152a or HFC-161; 134E and HFC-143, HFC-227ca, HFC-227ea, HFC-236ca, HFC-236cb, HFC-236ea, HFC-236fa, HFC-245cb, HFC-254cb, HFC-254eb, HFC-338mf or HFC-356mff; 134aE and HFC-32, HFC-134, HFC-143, HFC-152a, HFC-227ca, HFC-227ea or HFC-245cb; 143aE and HFC-32, HFC-134, HFC-143a, HFC-152a, HFC-227ca, HFC-227ea or HFC-245cb; C216E and HFC-134, HFC-134a, HFC-143, HFC-152a, HFC-161 or HFC-245cb; C-216E2 and HFC-32, HFC-134, HFC-134a, HFC-143, HFC-152a, HFC-161 or HFC-245cb; 218E and HFC-134, HFC-134a, HFC-143, HFC-152a, HFC-161 or HFC-263fb; 218E2 and HFC-134, HFC-134a, HFC-143, HFC-152a, HFC-161, HFC-236fa or HFC-263fb; C-225eE$\alpha\beta$ and HFC-143, HFC-236cb, HFC-236ea or HFC-245cb; 227caE$\alpha\beta$ and HFC-32, HFC-143, HFC-245cb, HFC-272ca, HFC-281ea or HFC-281fa; 227caE$\beta\gamma$ and HFC-32, HFC-134, HFC-134a, HFC-143, HFC-152a, HFC-161, HFC-263fb, HFC-272ca, HFC-281ea or HFC-281fa; 227eaE and HFC-32, HFC-134, HFC-134a, HFC-143, HFC-152a, HFC-161, HFC-263fb, HFC-272ca, HFC-281ea or HFC-281fa; C-234fE$\alpha\beta$ and HFC-245cb, HFC-245eb, HFC-356mff or HFC-356mmz; C-234fE$\beta\gamma$ and HFC-245ca, HFC-245cb, HFC-245ea, HFC-254ca, HFC-356mff or HFC-356mmz; 236caE and HFC-143, HFC-245ca or HFC-254ca; 236eaE$\beta\gamma$ and HFC-143, HFC-245ca, HFC-263ca, HFC-338mf, HFC-356mff or HFC-356mmz; 236faE and HFC-32, HFC-143, HFC-272ca, HFC-272fb or HFC-281fa; or 245faE$\beta\gamma$ and HFC-356mff.

Substantially constant boiling, azeotropic or azeotrope-like compositions of this invention comprise the following (all at 25°C):

TABLE 1

COMPONENTS	WEIGHT RANGES	PREFERRED
116E/HFC-32	50.0-88.0/12.0-50.0	50.0-88.0/12.0-50.0
116E/HFC-41	5.0-84.0/16.0-95.0	40.0-84.0/16.0-60.0
116E/HFC-125	1.0-99.0/1.0-99.0	20.0-99.0/1.0-80.0
116E/HFC-134	52.0-99.0/1.0-48.0	70.0-99.0/1.0-30.0
116E/HFC-134a	53.0-99.0/1.0-47.0	53.0-99.0/1.0-47.0
116E/HFC-143	60.0-99.0/1.0-40.0	60.0-99.0/1.0-40.0
116E/HFC-143a	1.0-99.0/1.0-99.0	30.0-99.0/1.0-70.0
116E/HFC-152a	60.0-99.0/1.0-40.0	60.0-99.0/1.0-40.0
116E/HFC-161	60.0-99.0/1.0-40.0	60.0-99.0/1.0-40.0
125E/HFC-32	25.0-73.0/27.0-75.0	30.0-70.0/30.0-70.0

125E/HFC-134	37.0-99.0/1.0-63.0	70.0-99.0/1.0-30.0
125E/HFC-134a	1.0-99.0/1.0-99.0	1.0-50.0/50.0-99.0
125E/HFC-143	1.0-43.0/57.0-99.0	1.0-30.0/70.0-99.0
125E/HFC-152a	1.0-61.0/39.0-99,0	1.0-40.0/60.0-99.0
125E/HFC-161	1.0-71.0/29.0-99.0	30.0-50.0/50.0-70.0
134E/HFC-143	1.0-99.0/1.0-99.0	1.0-50.0/50.0-99.0
134E/HFC-227ca	1.0-51.0/49.0-99.0	1.0-40.0/60.0-99.0
134E/HFC-227ea	1.0-49.0/51.0-99.0	1.0-40.0/60.0-99.0
134E/HFC-236ca	1.0-99.0/1.0-99.0	30.0-99.0/1.0-70.0
134E/HFC-236cb	1.0-99.0/1.0-99.0	1.0-70.0/30.0-99.0
134E/HFC-236ea	1.0-99.0/1.0-99.0	30.0-70.0/30.0-70.0
134E/HFC-236fa	1.0-99.0/1.0-99.0	1.0-80.0/20.0-99.0
134E/HFC-245cb	1.0-62.0/38.0-99.0	1.0-50.0/50.0-99.0
134E/HFC-254cb	1.0-99.0/1.0-99.0	1.0-70.0/30.0-99.0
134E/HFC-254eb	1.0-99.0/1.0-99.0	1.0-99.0/1.0-99.0
134E/HFC-338mf	27.0-99.0/1.0-73.0	40.0-80.0/20.0-60.0
134E/HFC-356mff	40.0-99.0/1.0-60.0	40.0-99.0/1.0-60.0
134aE/HFC-32	1.0-55.0/45.0-99.0	1.0-55.0/45.0-99.0
134aE/HFC-134	1.0-99.0/1.0-99.0	20.0-60.0/40.0-80.0
134aE/HFC-143	52.0-99.0/1.0-48.0	52.0-99.0/1.0-48.0
134aE/HFC-152a	1.0-99.0/1.0-99.0	1.0-99.0/1.0-99.0
134aE/HFC-227ca	1.0-99.0/1.0-99.0	20.0-99.0/1.0-80.0
134aE/HFC-227ea	1.0-99.0/1.0-99.0	20.0-99.0/1.0-80.0
134aE/HFC-245cb	1.0-99.0/1.0-99.0	20.0-99.0/1.0-80.0
143aE/HFC-32	1.0-54.0/46.0-99.0	1.0-54.0/46.0-99.0
143aE/HFC-134	1.0-99.0/1.0-99.0	30.0-99.0/1.0-70.0
143aE/HFC-143a	1.0-53.0/47.0-99.0	1.0-53.0/47.0-99.0
143aE/HFC-152a	1.0-99.0/1.0-99.0	20.0-80.0/20.0-80.0
143aE/HFC-227ca	1.0-99.0/1.0-99.0	1.0-80.0/20.0-99.0
143aE/HFC-227ea	1.0-99.0/1.0-99.0	1.0-90.0/10.0-99.0
143aE/HFC-245cb	20.0-99.0/1.0-80.0	20.0-80.0/20.0-80.0
C216E/HFC-134	1.0-99.0/1.0-99.0	50.0-99.0/1.0-50.0
C216E/HFC-134a	1.0-99.0/1.0-99.0	20.0-80.0/20.0-80.0
C216E/HFC-143	61.0-99.0/1.0-39.0	61.0-99.0/1.0-39.0
C216E/HFC-152a	1.0-99.0/1.0-99.0	20.0-99.0/1.0-80.0
C216E/HFC-161	1.0-99.0/1.0-99.0	20.0-99.0/1.0-80.0
C216E/HFC-245cb	1.0-99.0/1.0-99.0	30.0-99.0/1.0-70.0

C216E2/HFC-32	1.0-70.0/30.0-99.0	30.0-70.0/30.0-70.0
C216E2/HFC-134	1.0-99.0/1.0-99.0	20.0-99.0/1.0-80.0
C216E2/HFC-134a	1.0-99.0/1.0-99.0	1.0-80.0/20.0-99.0
C216E2/HFC-143	58.0/99.0/1.0-42.0	58.0-99.0/1.0-42.0
C216E2/HFC-152a	1.0-99.0/1.0-99.0	40.0-99.0/1.0-60.0
C216E2/HFC-161	1.0-84.0/16.0-99.0	20.0-84.0/16.0-80.0
C216E2/HFC-245cb	1.0-99.0/1.0-99.0	20.0-99.0/1.0-80.0
218E/HFC-134	35.0-99.0/1.0-65.0	50.0-80.0/20.0-50.0
218E/HFC-134a	1.0-99.0/1.0-99.0	20.0-80.0/20.0-80.0
218E/HFC-143	57.0-99.0/1.0-43.0	57.0-99.0/1.0-43.0
218E/HFC-152a	41.0-99.0/1.0-59.0	41.0-99.0/1.0-59.0
218E/HFC-161	39.0-84.0/16.0-61.0	39.0-84.0/16.0-61.0
218E/HFC-263fb	1.0-99.0/1.0-99.0	20.0-99.0/1.0-80.0
218E2/HFC-134	1.0-79.0/21.0-99.0	20.0-70.0/30.0-80.0
218E2/HFC-134a	1.0-72.0/28.0-99.0	1.0-60.0/40.0-99.0
218E2/HFC-143	52.0-91.0/9.0-48.0	52.0-91.0/9.0-48.0
218E2/HFC-152a	1.0-81.0/19.0-99.0	20.0-70.0/30.0-80.0
218E2/HFC-161	1.0-77.0/23.0-99.0	20.0-77.0/23.0-80.0
218E2/HFC-236fa	1.0-99.0/1.0-99.0	30.0-99.0/1.0-70.0
218E2/HFC-263fb	1.0-99.0/1.0-99.0	20.0-90.0/10.0-80.0
C225eE$\alpha\beta$/HFC-143	1.0-99.0/1.0-99.0	20.0-99.0/1.0-80.0
C225eE$\alpha\beta$/HFC-236cb	1.0-99.0/1.0-99.0	1.0-80.0/20.0-99.0
C225eE$\alpha\beta$/HFC-236ea	1.0-99.0/1.0-99.0	30.0-99.0/1.0-70.0
C225eE$\alpha\beta$/HFC-245cb	1.0-65.0/35.0-99.0	1.0-65.0/35.0-99.0
227caE$\alpha\beta$/HFC-32	1.0-61.0/39.0-99.0	1.0-61.0/39.0-99.0
227caE$\alpha\beta$/HFC-143	42.0-99.0/1.0-58.0	42.0-95.0/5.0-58.0
227caE$\alpha\beta$/HFC-245cb	1.0-82.0/18.0-99.0	1.0-80.0/20.0-99.0
227caE$\alpha\beta$/HFC-272ca	1.0-99.0/1.0-99.0	30.0-99.0/1.0-70.0
227caE$\alpha\beta$/HFC-281ea	1.0-99.0/1.0-99.0	40.0-99.0/1.0-60.0
227caE$\alpha\beta$/HFC-281fa	1.0-99.0/1.0-99.0	40.0-99.0/1.0-60.0
227caE$\beta\gamma$/HFC-32	1.0-67.0/33.0-99.0	1.0-67.0/33.0-99.0
227caE$\beta\gamma$/HFC-134	1.0-76.0/24.0-99.0	10.0-50.0/50.0-90.0
227caE$\beta\gamma$/HFC-134a	1.0-67.0/33.0-99.0	1.0-67.0/33.0-99.0
227caE$\beta\gamma$/HFC-143	46.0-91.0/9.0-54.0	46-91.0/9.0-54.0
227caE$\beta\gamma$/HFC-152a	1.0-78.0/22.0-99.0	10.0-78.0/22.0-90.0
227caE$\beta\gamma$/HFC-161	1.0-72.0/28.0-99.0	10.0-72.0/28.0-90.0
227caE$\beta\gamma$/HFC-263fb	1.0-99.0/1.0-99.0	20.0-99.0/1.0-80.0

227caEβγ/HFC-272ca	1.0-99.0/1.0-99.0	30.0-99.0/1.0-70.0
227caEβγ/HFC-281ea	1.0-99.0/1.0-99.0	40.0-99.0/1.0-60.0
227caEβγ/HFC-281fa	1.0-99.0/1.0-99.0	40.0-99.0/1.0-60.0
227eaE/HFC-32	1.0-68.0/32.0-99.0	10.0-68.0/32.0-90.0
227eaE/HFC-134	1.0-78.0/22.0-99.0	10.0-60.0/40.0-90.0
227eaE/HFC-134a	1.0-70.0/30.0-99.0	1.0-60.0/40.0-99.0
227eaE/HFC-143	47.0-92.0/8.0-53.0	47.0-92.0/8.0-53.0
227eaE/HFC-152a	1.0-80.0/20.0-99.0	10.0-80.0/20.0-90.0
227eaE/HFC-161	1.0-73.0/27.0-99.0	20.0-73.0/27.0-80.0
227eaE/HFC-263fb	1.0-99.0/1.0-99.0	30.0-99.0/1.0-70.0
227eaE/HFC-272ca	30.0-99.0/1.0-70.0	30.0-99.0/1.0-70.0
227eaE/HFC-281ea	1.0-99.0/1.0-99.0	40.0-99.0/1.0-60.0
227eaE/HFC-281fa	1.0-99.0/1.0-99.0	40.0-99.0/1.0-60.0
C234fEαβ/HFC-245cb	1.0-58.0/42.0-99.0	1.0-58.0/42.0-99.0
C234fEαβ/HFC-245eb	1.0-99.0/1.0-99.0	20.0-99.0/1.0-80.0
C234fEαβ/HFC-356mff	1.0-99.0/1.0-99.0	20.0-80.0/20.0-80.0
C234fEαβ/HFC-356mmz	1.0-99.0/1.0-99.0	20.0-80.0/20.0-80.0
C-234fEβγ/HFC-245ca	1.0-99.0/1.0-99.0	10.0-80.0/20.0-90.0
C-234fEβγ/HFC-245cb	1.0-56.0/46.0-99.0	1.0-40.0/60.0-99.0
C-234fEβγ/HFC-245ea	1.0-99.0/1.0-99.0	10.0-89.0/21.0-90.0
C-234fEβγ/HFC-254ca	1.0-99.0/1.0-99.0	10.0-99.0/1.0-90.0
C-234fEβγ/HFC-356mff	1.0-99.0/1.0-99.0	20.0-80.0/20.0-80.0
C-234fEβγ/HFC-356mmz	1.0-82.0/18.0-99.0	1.0-60.0/40.0-99.0
236caE/HFC-143	1.0-60.0/40.0-99.0	10.0-60.0/40.0-90.0
236caE/HFC-254ca	1.0-99.0/1.0-99.0	1.0-80.0/20.0-99.0
236caE/HFC-245ca	1.0-99.0/1.0-99.0	1.0-80.0/20.0-99.0
236eaEβγ/HFC-143	1.0-66.0/34.0-99.0	10.0-66.0/34.0-90.0
236eaEβγ/HFC-245ca	1.0-99.0/1.0-99.0	20.0-99.0/1.0-80.0
236eaEβγ/HFC-263ca	1.0-99.0/1.0-99.0	1.0-99.0/1.0-99.0
236eaEβγ/HFC-338mf	1.0-99.0/1.0-99.0	20.0-99.0/1.0-80.0
236eaEβγ/HFC-356mff	1.0-99.0/1.0-99.0	20.0-99.0/1.0-80.0
236eaEβγ/HFC-356mmz	1.0-99.0/1.0-99.0	1.0-80.0/20.0-99.0
236faE/HFC-32	1.0-55.0/45.0-99.0	1.0-55.0/45.0-99.0
236faE/HFC-143	28.0-84.0/16.0-72.0	30.0-84.0/16.0-70.0
236faE/HFC-272ca	1.0-99.0/1.0-99.0	10.0-99.0/1.0-90.0
236faE/HFC-272fb	1.0-99.0/1.0-99.0	40.0-99.0/1.0-60.0
236faE/HFC-281fa	1.0-99.0/1.0-99.0	1.0-99.0/1.0-99.0

245faEβγ/HFC-356mff	1.0-99.0/1.0-99.0	1.0-70.0/30.0-99.0

For purposes of this invention, "effective amount" is defined as the amount of each component of the inventive compositions which, when combined, results in the formation of an azeotropic or azeotrope-like composition. This definition includes the amounts of each component, which amounts may vary depending on the pressure applied to the composition so long as the azeotropic or azeotrope-like compositions continue to exist at the different pressures, but with possible different boiling points.

Therefore, effective amount includes the amounts, such as may be expressed in weight percentages, of each component of the compositions of the instant invention which form azeotropic or azeotrope-like compositions at temperatures or pressures other than as described herein.

For the purposes of this discussion, azeotropic or constant-boiling is intended to mean also essentially azeotropic or essentially-constant boiling. In other words, included within the meaning of these terms are not only the true azeotropes described above, but also other compositions containing the same components in different proportions, which are true azeotropes at other temperatures and pressures, as well as those equivalent compositions which are part of the same azeotropic system and are azeotrope-like in their properties. As is well recognized in this art, there is a range of compositions which contain the same components as the azeotrope, which will not only exhibit essentially equivalent properties for refrigeration and other applications, but which will also exhibit essentially equivalent properties to the true azeotropic composition in terms of constant boiling characteristics or tendency not to segregate or fractionate on boiling.

It is possible to characterize, in effect, a constant boiling admixture which may appear under many guises, depending upon the conditions chosen, by any of several criteria:

* The composition can be defined as an azeotrope of A, B, C (and D...) since the very term "azeotrope" is at once both definitive and limitative, and requires that effective amounts of A, B, C (and D...) for this unique composition of matter which is a constant boiling composition.
* It is well known by those skilled in the art, that, at different pressures, the composition of a given azeotrope will vary at least to some degree, and changes in pressure will also change, at least to some degree, the boiling point temperature. Thus, an azeotrope of A, B, C (and D...) represents a unique type of relationship but with a

variable composition which depends on temperature and/or pressure. Therefore, compositional ranges, rather than fixed compositions, are often used to define azeotropes.

* The composition can be defined as a particular weight percent relationship or mole percent relationship of A, B, C (and D...), while recognizing that such specific values point out only one particular relationship and that in actuality, a series of such relationships, represented by A, B, C (and D...) actually exist for a given azeotrope, varied by the influence of pressure.

* An azeotrope of A, B, C (and D...) can be characterized by defining the compositions as an azeotrope characterized by a boiling point at a given pressure, thus giving identifying characteristics without unduly limiting the scope of the invention by a specific numerical composition, which is limited by and is only as accurate as the analytical equipment available.

The azeotrope or azeotrope-like compositions of the present invention can be prepared by any convenient method including mixing or combining the desired amounts. A preferred method is to weigh the desired component amounts and thereafter combine them in an appropriate container.

There is no universally accepted methodology for combining all relevant factors into a single global warming potential for greenhouse gas emissions. One way to define the greenhouse effect of a compound is to determine its potential to enhance global warming relative to a known standard. In the present invention, the halocarbon global warming potential (HGWP) of several fluoroethers and HFCs were determined using known estimating techniques.

HGWP is defined as the ratio of incremental radiative warming resulting from an emission of a gas, over the lifetime of the gas in the atmosphere, to the calculated warming that would result from a release of the same mass of reference gas CFC-11, which has an HGWP of 1.0. The calculation of HGWP is discussed in Fisher et. al., Model Calculations on the Relative Effects of CFCs and their Replacements on Global Warming, Nature, Volume 344, pp. 513-516 (1990), the text of which is incorporated herein by reference.

It has been discovered that the HGWP of an HFC can be lowered by adding to the HFC a fluoroether having a lower HGWP than the HGWP of the HFC such that the combination of the HFC and the fluoroether has an HGWP lower than the HGWP of the HFC. Therefore, the present invention relates to a composition of a first component that includes a hydrofluorocarbon and a second

component that includes a fluoroether that has an HGWP less than the HGWP of the first component, such that the HGWP of the composition is less than the HGWP of the first component.

The scope of this invention includes a single fluoroether compound added to a single HFC, as well as a single fluoroether added to mixtures of two or more HFCs. Further, the invention includes mixtures of one or more fluoroethers added to a single HFC, as well as mixtures of one or more fluoroethers added to mixtures of two or more HFCs.

The HGWP of a composition of components A and B is equal to [fractional composition of A] x [HGWP of A] + [fractional composition of B] x [HGWP of B]. The HGWP of a composition of more than two components is determined in the same way, that is, by multiplying the fractional composition of a component by its HGWP, and then adding together the fractional HGWPs of all the components.

Specific examples illustrating the invention are given below. Unless otherwise stated therein, all percentages are by weight. It is to be understood that these examples are merely illustrative and in no way are to be interpreted as limiting the scope of the invention. All values given in the Examples are +/- 5 percent.

EXAMPLE 1

Phase Study

A phase study on the following compositions, wherein the composition is varied and the vapor pressures are measured, at a constant temperature of 25°C, shows that the following compositions are azeotropic.

TABLE 2

Weight % Fluoroether	Weight % HFC	Vapor Press. psia (kPa)
75.2 wt.% 116E	24.8 wt.% HFC-32	490.5 (3382)
58.6 wt.% 116E	41.4 wt.% HFC-41	575.6 (3969)
86.0 wt.% 116E	14.0 wt.% HFC-125	295.6 (2038)
90.2 wt.% 116E	9.8 wt.% HFC-134	302.7 (2087)
90.0 wt.% 116E	10.0 wt.% HFC-134a	299.5 (2065)
94.9 wt.% 116E	5.1 wt.% HFC-143	305.9 (2109)
94.8 wt.% 116E	5.2 wt.% HFC-143a	293.1 (2021)
92.1 wt.% 116E	7.9 wt.% HFC-152a	305.4 (2106)
87.3 wt.% 116E	12.7 wt.% HFC-161	344.3 (2374)

86.5 wt.% 125E	13.5 wt.% HFC-134	130.7 (901)
92.0 wt% 125E	8.0 wt% HFC-143	132.0 (910)
84.4 wt% 125E	15.6 wt% HFC-152a	134.1 (925)
66.5 wt% 125E	33.5 wt% HFC-161	171.1 (1179)
37.9 wt% 134E	62.1 wt% HFC-143	34.0 (235)
13.6 wt% 134E	86.4 wt% HFC-227ca	65.9 (454)
7.3 wt% 134E	92.7 wt.% HFC-227ea	67.2 (463)
78.0 wt% 134E	22.0 wt% HFC-236ca	63.8 (440)
36.3 wt% 134E	63.7 wt% HFC-236cb	36.3 (250)
52.8 wt% 134E	47.2 wt% HFC-236ea	33.3 (229)
14.2 wt.% 134E	85.8 wt.% HFC-236fa	39.8 (274)
28.5 wt% 134E	71.5 wt% HFC-245cb	80.0 (551)
29.7 wt% 134E	70.3 wt% HFC-254cb	34.9 (241)
28.6 wt.% 134E	71.4 wt.% HFC-254eb	35.5 (245)
97.1 wt.% 134E	2.9 wt.% HFC-356mff	30.4 (210)
65.5 wt% 134E	34.5 wt% HFC-338mf	33.2 (229)
11.5 wt.% 134aE	88.5 wt.% HFC-32	249.2 (1718)
42.6 wt.% 134aE	57.4 wt.% HFC-134	78.3 (540)
98.1 wt.% 134aE	1.9 wt.% HFC-143	73.9 (510)
19.1 wt.% 134aE	80.9 wt.% HFC-152a	86.0 (593)
65.5 wt% 134aE	34.5 wt% HFC-227ca	76.3 (526)
65.4 wt.% 134aE	34.6 wt.% HFC-227ea	75.4 (520)
57.7 wt.% 134aE	42.3 wt.% HFC-245cb	91.7 (632)
6.2 wt.% 143aE	93.8 wt.% HFC-32	247.4 (1706)
92.4 wt.% 143aE	7.6 wt. % HFC-134	127.6 (880)
8.7 wt.% 143aE	91.3 wt.% HFC-143a	182.2 (1256)
48.6 wt.% 143aE	51.4 wt.% HFC-152a	87.3 (602)
71.5 wt% 143aE	28.5 wt% HFC-227ca	85.9 (592)
75.6 wt.% 143aE	24.4 wt.% HFC-227ea	84.8 (585)
59.6 wt.% 143aE	40.4 wt.% HFC-245cb	102.8 (709)
79.8 wt.% C216E	20.2 wt.% HFC-134	104.4 (720)
61.7 wt.% C216E	38.3 wt.% HFC-134a	108.0 (744)
91.9 wt.% C216E	8.1 wt.% HFC-143	103.5 (714)
77.6 wt.% C216E	22.4 wt.% HFC-152a	109.1 (752)
58.8 wt.% C216E	41.2 wt.% HFC-161	148.3 (1022)
95.1 wt.% C216E	4.9 wt.% HFC-245cb	100.6 (693)
36.0 wt.% C216E2	64.0 wt.% HFC-32	272.4 (1878)
60.5 wt.% C216E2	39.5 wt.% HFC-134	88.6 (611)
20.6 wt.% C216E2	79.4 wt.% HFC-134a	99.0 (683)
87.1 wt.% C216E2	12.9 wt.% HFC-143	82.9 (572)
60.5 wt.% C216E2	39.5 wt.% HFC-152a	95.6 (659)
45.7 wt.% C216E2	54.3 wt.% HFC-161	138.3 (954)

74.7 wt.% C216E2	25.3 wt.% HFC-245cb	81.3 (561)
63.3 wt. %218E	36.7 wt. % HFC-134	116.6 (804)
53.0 wt.% 218E	47.0 wt.% HFC-134a	122.3 (843)
85.3 wt.% 218E	14.7 wt.% HFC-143	103.7 (715)
68.2 wt.% 218E	31.8 wt.% HFC-152a	124.0 (855)
62.6 wt.% 218E	37.4 wt.% HFC-161	170.9 (1178)
96.3 wt.% 218E	3.7 wt.% HFC-263fb	84.0 (579)
46.1 wt.% 218E2	53.9 wt.% HFC-134	89.6 (617)
24.7 wt.% 218E2	75.3 wt.% HFC-134a	101.1 (697)
78.3 wt.% 218E2	21.7 wt.% HFC-143	72.6 (501)
51.0 wt.% 218E2	49.0 wt.% HFC-152a	98.1 (676)
46.4 wt.% 218E2	53.6 wt.% HFC-161	145.1 (1000)
89.8 wt.% 218E2	10.2 wt.% HFC-236fa	52.6 (363)
60.5 wt.% 218E2	39.5 wt.% HFC-263fb	57.9 (399)
55.9 wt.% C225eE$\alpha\beta$	44.1 wt.% HFC-143	38.0 (2626)
16.7 wt.% C225eE$\alpha\beta$	83.3 wt.% HFC-236cb	33.7 (232)
91.5 wt.% C225eE$\alpha\beta$	8.5 wt.% HFC-236ea	31.1 (214)
22.4 wt.% C225eE$\alpha\beta$	77.6 wt.% HFC-245cb	70.1 (483)
17.9 wt.% 227caE$\alpha\beta$	82.1 wt.% HFC-32	253.4 (1747)
70.9 wt.% 227caE$\alpha\beta$	29.1 wt.% HFC-143	53.7 (370)
8.1 wt.% 227caE$\alpha\beta$	91.9 wt.% HFC-245cb	67.4 (465)
94.3 wt.% 227caE$\alpha\beta$	5.7 wt.% HFC-272ca	41.5 (286)
31.5 wt.% 227caE$\alpha\beta$	68.5 wt.% HFC-281ea	47.3 (326)
84.3 wt.% 227caE$\alpha\beta$	15.7 wt.% HFC-281fa	42.5 (293)
28.4 wt.% 227caE$\beta\gamma$	71.6 wt.% HFC-32	269.7 (1859)
34.8 wt.% 227caE$\beta\gamma$	65.2 wt.% HFC-134	82.7 (570)
1.9 wt.% 227caE$\beta\gamma$	98.1 wt.% HFC-134a	98.3 (678)
73.8 wt.% 227caE$\beta\gamma$	26.2 wt.% HFC-143	66.2 (456)
38.3 wt.% 227caE$\beta\gamma$	61.7 wt.% HFC-152a	91.4 (630)
34.4 wt.% 227caE$\beta\gamma$	65.6 wt.% HFC-161	137.5 (948)
32.9 wt.% 227caE$\beta\gamma$	67.1 wt.% HFC-263fb	54.6 (376)
89.0 wt.% 227caE$\beta\gamma$	11.0 wt.% HFC-272ca	49.6 (342)
73.1 wt.% 227caE$\beta\gamma$	26.9 wt.% HFC-281ea	54.0 (372)
85.9 wt.% 227caE$\beta\gamma$	14.1 wt.% HFC-281fa	51.1 (352)
30.0 wt.% 227eaE	70.0 wt.% HFC-32	272.2 (1877)
38.2 wt.% 227eaE	61.8 wt. % HFC-134	84.7 (584)
9.3 wt.% 227eaE	90.7 wt.% HFC-134a	98.6 (680)
74.9 wt.% 227eaE	25.1 wt.% HFC-143	68.9 (475)
42.1 wt.% 227eaE	57.9 wt.% HFC-152a	93.3 (643)
37.5 wt.% 227eaE	62.5 wt.% HFC-161	139.5 (962)
49.3 wt.% 227eaE	50.7 wt.% HFC-263fb	55.7 (384)
90.7 wt.% 227eaE	9.3 wt.% HFC-272ca	52.1 (359)

76.8 wt.% 227eaE	23.2 wt.% HFC-281ea	56.0 (386)
87.6 wt.% 227eaE	12.4 wt.% HFC-281fa	53.4 (368)
13.5 wt.% C-234fE$\alpha\beta$	86.5 wt.% HFC-245cb	69.9 (482)
49.1 wt.% C-234fE$\alpha\beta$	50.9 wt.% HFC-245eb	17.6 (121)
59.0 wt.% C-234fE$\alpha\beta$	41.0 wt.% HFC-356mff	18.8 (130)
50.1 wt.% C-234fE$\alpha\beta$	49.9 wt.% HFC-356mmz	20.1 (139)
33.6 wt.% C-234fE$\beta\gamma$	66.4 wt.% HFC-245ca	14.5 (100)
10.2 wt.% C-234fE$\beta\gamma$	89.8 wt.% HFC-245cb	69.1 (476)
36.0 wt.% C-234fE$\beta\gamma$	64.0 wt.% HFC-245ea	14.5 (100)
36.0 wt.% C-234fE$\beta\gamma$	64.0 wt.% HFC-254ca	13.8 (95)
43.1 wt.% C-234fE$\beta\gamma$	56.9 wt.% HFC-356mff	17.1 (118)
35.8 wt.% C-234fE$\beta\gamma$	64.2 wt.% HFC-356mmz	18.6 (128)
12.0 wt.% 236caE	88.0 wt.% HFC-143	33.4 (230)
17.6 wt.% 236caE	82.4 wt.% HFC-254ca	13.8 (95)
25.9 wt.% 236eaE$\beta\gamma$	74.1 wt.% HFC-143	34.7(239)
69.1 wt.% 236eaE$\beta\gamma$	30.9 wt.% HFC-245ca	16.1 (111)
4.1 wt.% 236eaE$\beta\gamma$	95.9 wt.% HFC-263ca	18.3 (126)
92.6 wt.% 236eaE$\beta\gamma$	7.49 wt.% HFC-338mf	18.9 (130)
96.9 wt.% 236eaE$\beta\gamma$	3.1 wt.% HFC-356mff	15.7 (108)
15.1 wt.% 236eaE$\beta\gamma$	84.9 wt.% HFC-356mmz	16.7 (115)
8.5 wt.% 236faE	91.5 wt.% HFC-32	248.6 (1714)
56.9 wt.% 236faE	43.1 wt.% HFC-143	45.1 (311)
27.8 wt.% 236faE	72.2 wt.% HFC-272ca	34.8 (240)
82.3 wt.% 236faE	17.7 wt.% HFC-272fb	30.2 (208)
9.3 wt.% 236faE	90.7 wt.% HFC-281fa	37.7 (260)
4.4 wt.% 245faE$\beta\gamma$	95.6 wt.% HFC-356mff	14.9 (103)

EXAMPLE 2

Impact of Vapor Leakage on Vapor Pressure at 25°C

A vessel is charged with an initial composition at 25°C, and the vapor pressure of the composition is measured. The composition is allowed to leak from the vessel, while the temperature is held constant at 25°C, until 50 weight percent of the initial composition is removed, at which time the vapor pressure of the composition remaining in the vessel is measured. The results are summarized below.

TABLE 3

Refrigerant Composition	0 wt% evaporated psia (kPa)	50 wt% evaporated psia (kPa)	% change in vapor pressure
116E/HFC-32			
75.2/24.8	490.6(3385)	490.6(3385)	0.0
89/11	484.3(3341)	434.4(2297)	10.3
88/12	485.8(3352)	451.4(3114)	7.1
70/30	490.4(3383)	490.0(3381)	0.6
60/40	489.6(3378)	488.0(3367)	0.3
50/50	488.8(3372)	486.1(3354)	0.6
80/20	490.2(3382)	489.1(3374)	0.2
116E/HFC-41			
58.6/41.4	575.6(3971)	575.6(3971)	0.0
70/30	572.4(3949)	566.7(3910)	1.0
85/15	540.4(3728)	483.1(3333)	10.6
84/16	544.9(3759)	493.7(3406)	9.3
40/60	571.3(3942)	558.5(3853)	2.2
30/70	565.7(3903)	515.9(3559)	8.8
28/72	564.1(3892)	505.8(3490)	10.3
29/71	564.9(3897)	510.7(3523)	9.6
5/95	512.9(3539)	477.9(3297)	6.6
116E/HFC-125			
86.0/14.0	295.6(2039)	295.6(2039)	0.0
99/1	292.7(2019)	292.6(2018)	0.0
70/30	292.2(2016)	291.1(2008)	0.4
60/40	297.3(2051)	284.0(1959)	4.5
50/50	280.6(1936)	273.9(1889)	2.4
40/60	272.0(1876)	260.5(1797)	4.4
30/70	261.0(1800)	244.0(1683)	6.5

	10/90	227.3(1568)	209.5(1445)	7.2
	1/99	202.5(1397)	199.8(1378)	1.3
	116E/HFC-134			
	99.0/1.0	294.8 (2033)	294.0 (2027)	0.3
	90.2/9.8	302.7 (2087)	302.7 (2087)	0.0
	70.0/30.0	293.5 (2024)	285.2 (1967)	2.8
	52.0/48.0	283.9 (1957)	258.0 (1779)	9.1
	116E/HFC-134a			
	90.0/10.0	299.5(2066)	299.5(2066)	0.0
	99/1	293.8(2027)	293.5(2025)	0.0
	52/48	276.8(1909)	248.6(1715)	10.2
	53/47	277.5(1914)	251.8(1737)	9.3
	60/40	282.6(1949)	267.0(1842)	5.5
	70/30	289.7(1998)	281.6(1943)	2.8
	80/20	296.2(2043)	293.7(2026)	0.8
	116E/HFC-143			
	94.9/5.1	305.9(2110)	305.9(2110)	0.0
	99/1	300.2(2071)	295.6(2039)	1.5
	80/20	299.2(2064)	295.9(2041)	1.1
	70/30	293.5(2025)	285.2(1967)	2.8
	65/35	290.6(2005)	280.2(1933)	3.5
	61/39	300.6(2074)	298.3(2058)	0.8
	60/40	300.6(2074)	283.6(1956)	5.6
	116E/HFC-143a			
	94.8/5.2	293.1(2022)	293.1(2022)	0.0
	70/30	281.6(1943)	277.4(1914)	1.5
	60/40	273.6(1887)	265.0(1828)	3.1
	50/50	264.3(1823)	250.0(1725)	5.4
	40/60	253.7(1750)	232.3(1602)	8.4
	10/90	206.8(1426)	186.0(1283)	10.1
	1/99	183.6(1266)	180.9(1248)	1.5
	99/1	292.5(2018)	292.5(2018)	0.0
	116E/HFC-152a			
	92.1/7.9	305.5(2108)	305.5(2108)	0.0
	99/1	296.4(2045)	295.1(2036)	0.4
	70/30	292.3(2016)	280.4(1934)	4.1
	60/40	286.6(1977)	259.3(1789)	9.5
	116E/HFC-161			
	87.3/12.7	344.4(2376)	244.4(2376)	0.0
	99/1	307.4(2121)	297.5(2052)	3.2
	70/30	337.9(2331)	330.2(2278)	2.3

	60/40	334.1(2305)	308.4(2128)	7.7
	95/5	335.6(2315)	324.8(2241)	3.2
	125E/HFC-32			
	1.0/99.0	246.2 (1697)	245.9 (1695)	0.1
	10.0/90.0	241.2 (1663)	238.8 (1646)	1.0
	20.0/80.0	235.0 (1620)	230.0 (1586)	2.1
	30.0/70.0	227.8 (1571)	220.1 (1518)	3.4
	40.0/60.0	219.4 (1513)	209.3 (1443)	4.6
	50.0/50.0	209.5 (1444)	197.4 (1361)	5.8
	60.0/40.0	197.9 (1364)	184.7 (1273)	6.7
	70.0/30.0	184.4 (1271)	171.2 (1180)	7.2
	80.0/20.0	168.5 (1162)	157.2 (1084)	6.7
	90.0/10.0	149.9 (1034)	142.8 (985)	4.7
	99.0/1.0	130.8 (902)	129.9 (896)	0.7
	125E/HFC-134			
	37.0/63.0	116.3 (802)	105.1 (725)	9.6
	70.0/30.0	128.6 (887)	127.6 (880)	0.8
	86.5/13.5	130.7 (901)	130.7 (901)	0.0
	99.0/1.0	128.9 (889)	128.8 (888)	0.1
	125E/HFC-134a			
	1.0/99.0	98.5 (679)	98.5 (679)	0.0
	10.0/90.0	100.9 (696)	100.4 (692)	0.5
	20.0/80.0	103.5 (714)	102.6 (707)	0.9
	30.0/70.0	106.2 (732)	105.0 (724)	1.1
	40.0/60.0	108.9 (751)	107.6 (742)	1.2
	50.0/50.0	111.8 (771)	110.4 (761)	1.3
	60.0/40.0	114.8 (792)	113.4 (782)	1.2
	70.0/30.0	117.9 (813)	116.7 (805)	1.0
	80.0/20.0	121.3 (836)	120.3 (829)	0.8
	90.0/10.0	124.8 (860)	124.2 (856)	0.5
	99.0/1.0	128.1 (883)	128.1 (883)	0.0
	125E/HFC-143			
	57.0/43.0	123.5 (852)	112.1 (773)	9.2
	60.0/40.0	124.2 (856)	115.9 (799)	6.7
	70.0/30.0	126.9 (875)	122.4 (844)	3.6
	92.0/ 8.0	132.0 (910)	132.0 (190)	0.0
	99.0/ 1.0	129.5 (893)	129.3 (892)	0.2

	125E/HFC-152a			
	39.0/61.0	120.3 (829)	108.6 (747)	9.7
	50.0/50.0	125.3 (864)	118.5 (817)	5.4
	60.0/40.0	129.0 (889)	125.6 (866)	2.7
	84.4/15.6	134.1 (925)	134.1 (925)	0.0
	99.0/ 1.0	129.4 (892)	129.2 (891)	0.2
	125E/HFC-161			
	29.0/71.0	161.6 (1114)	145.8 (1006)	9.8
	50.0/50.0	169.0 (1165)	166.3 (1146)	1.6
	66.5/33.5	171.1 (1179)	171.1 (1179)	0.0
	70.0/30.0	170.9 (1179)	170.8 (1177)	0.1
	99.0/ 1.0	133.2 (919)	130.5 (900)	2.1
	134E/HFC-143			
	1.0/99.0	33.1 (228)	33.1 (228)	0.0
	37.9/62.1	34.0 (235)	34.0 (235)	0.0
	50.0/50.0	33.9 (234)	33.9 (234)	0.0
	70.0/30.0	33.2 (229)	33.1 (228)	0.4
	99.0/1.0	30.6 (211)	30.5 (210)	0.1
	134E/HFC-227ca			
	1.0/99.0	64.2 (443)	64.1 (442)	0.1
	13.6/86.4	65.9 (454)	65.9 (454)	0.0
	30.0/70.0	64.6 (445)	63.5 (438)	1.6
	40.0/60.0	63.0 (434)	60.4 (416)	4.1
	51.0/49.0	60.9 (420)	55.0 (379)	9.6
	134E/HFC-227ea			
	7.3/92.7	67.2 (463)	67.2 (463)	0.0
	1.0/99.0	66.8 (461)	66.8 (461)	0.0
	40.0/60.0	62.6 (432)	59.3 (409)	5.3
	50.0/50.0	60.3 (416)	54.0 (372)	10.4
	49.0/51.0	60.6 (418)	54.6 (376)	9.9
	134E/HFC-236ca			
	78.0/22.0	29.5(203)	29.5(203)	0.0
	90/10	29.4(202)	29.4(202)	0.0
	99/1	29.2(201)	29.2(201)	0.0
	70/30	29.4(202)	29.4(202)	0.0
	60/40	29.3(202)	29.2(201)	0.3
	50/50	29.0(200)	29.0(200)	0.0
	30/70	28.0(193)	27.7(191)	1.1
	10/90	26.2(180)	26.0(179)	0.8
	1/99	25.1(173)	25.0(172)	0.4

	134E/HFC-236cb			
	1.0/99.0	33.8 (233)	33.8 (233)	0.0
	36.3/63.7	36.3 (250)	36.3 (250)	0.0
	40.0/60.0	36.3 (250)	36.3 (250)	0.0
	70.0/30.0	34.8 (240)	34.3 (236)	1.6
	99.0/1.0	30.6 (211)	30.5 (210)	0.3
	134E/HFC-236ea			
	1.0/99.0	28.9 (199)	28.9 (199)	0.0
	30.0/70.0	32.6 (225)	32.4 (223)	0.7
	52.8/47.2	33.3 (229)	33.3 (229)	0.0
	70.0/30.0	32.9 (227)	32.8 (226)	0.3
	99.0/1.0	30.6 (211)	30.5 (210)	0.3
	134E/HFC-236fa			
	14.2/85.8	39.8 (274)	39.8 (274)	0.0
	1.0/99.0	39.4 (272)	39.4 (272)	0.0
	40.0/60.0	38.8 (268)	38.6 (266)	0.5
	60.0/40.0	37.1 (256)	36.3 (250)	2.2
	80.0/20.0	34.4 (237)	33.3 (230)	3.2
	99.0/ 1.0	30.7 (212)	30.5 (210)	0.7
	134E/HFC-245cb			
	1.0/99.0	69.0 (476)	67.8 (467)	1.7
	28.5/71.5	80.0 (551)	80.0 (551)	0.0
	40.0/60.0	79.6 (549)	79.0 (545)	0.7
	50.0/50.0	78.9 (544)	77.4 (534)	1.9
	62.0/38.0	77.9 (537)	71.4 (492)	8.4
	134E/HFC-254cb			
	1.0/99.0	34.2 (236)	34.2 (236)	0.0
	29.7/70.3	34.9 (241)	34.9 (241)	0.0
	40.0/60.0	34.8 (240)	34.8 (240)	0.0
	70.0/30.0	33.6 (232)	33.4 (230)	0.7
	99.0/1.0	30.6 (211)	30.5 (210)	0.1
	134E/HFC-254eb			
	28.6/71.4	35.5 (245)	35.5 (245)	0.0
	15.0/85.0	35.3 (243)	35.3 (243)	0.0
	1.0/99.0	34.8 (240)	34.8 (240)	0.0
	60.0/40.0	34.7 (239)	34.5 (238)	0.6
	80.0/20.0	33.1 (228)	32.7 (225)	1.2
	99.0/ 1.0	30.6 (211)	30.5 (210)	0.3
	134E/HFC-338mf			
	27.0/73.0	30.5 (210)	27.6 (190)	9.4
	40.0/60.0	32.2 (222)	31.1 (214)	3.4

	65.5/34.5	33.2 (229)	33.2 (229)	0.0
	80.0/20.0	32.9 (227)	32.6 (225)	0.8
	99.0/1.0	30.6 (211)	30.5 (210)	0.4
	134E/HFC-356mff			
	97.1/2.9	30.4 (210)	30.4 (210)	0.0
	99.0/1.0	30.4 (210)	30.4 (210)	0.0
	60.0/40.0	28.7 (198)	27.8 (192)	3.1
	40.0/60.0	26.4 (182)	23.9 (165)	9.5
	39.0/61.0	26.3 (181)	23.6 (163)	10.3
	134aE/HFC-32			
	11.5/88.5	249.1(1718)	249.1(1718)	0.0
	1/99	247.2(1705)	247.1(1705)	0.0
	20/80	248.3(1713)	247.7(1709)	0.2
	30/70	245.8(1695)	243.0(1676)	1.1
	56/44	231.1(1594)	207.6(1432)	10.2
	55/45	232.0(1600)	210.0(1449)	9.5
	40/60	241.9(1669)	234.5(1618)	3.0
	134aE/HFC-134			
	99.0/1.0	74.0 (510)	74.0 (510)	0
	60.0/40.0	77.9 (537)	77.9 (537)	0
	42.6/57.4	78.3 (540)	78.3 (540)	0
	20.0/80.0	77.7 (536)	77.7 (536)	0
	1.0/99.0	76.2 (525)	76.2 (525)	0
	134aE/HFC-143			
	99.0/1.0	73.8 (509)	73.8 (509)	0
	98.1/1.9	73.9 (510)	73.9 (510)	0
	52.0/48.0	65.0 (448)	58.7 (405)	9.7
	134aE/HFC-152a			
	19.1/80.9	86.1(594)	86.1(594)	0.0
	10/90	86.0(593)	86.0(593)	0.0
	1/99	85.8(592)	85.8(592)	0.0
	30/70	86.0(593)	86.0(593)	0.0
	50/50	85.0(586)	84.9(585)	0.1
	70/30	82.7(570)	82.2(567)	0.6
	80/20	80.7(556)	80.0(552)	0.9
	99/1	74.3(512)	74.2(512)	0.1
	134aE/HFC-227ca			
	65.5/34.5	76.2(525)	76.2(525)	0.0
	80/20	75.8(523)	75.8(523)	0.0
	90/10	75.0(517)	74.9(516)	0.1
	99/1	74.0(510)	73.9(510)	0.1

	50/50	75.7(522)	75.6(521)	0.1
	40/60	74.8(516)	74.4(513)	0.5
	30/70	73.4(506)	72.7(501)	1.0
	20/90	71.2(491)	70.2(484)	1.4
	1/99	64.2(443)	64.1(442)	0.3
	134aE/HFC-227ea			
	65.4/34.6	75.5(521)	75.5(521)	0.0
	80/20	75.2(518)	75.1(518)	0.1
	90/10	74.6(514)	74.6(514)	0.0
	99/1	73.9(509)	73.9(509)	0.0
	50/50	75.1(518)	75.0(517)	0.1
	30/70	73.4(506)	73.0(503)	0.5
	10/90	69.6(480)	69.2(477)	0.6
	1/99	67.0(462)	67.0(462)	0.0
	134aE/HFC-245cb			
	57.7/42.3	91.6(632)	91.6(632)	0.0
	70/30	90.9(627)	90.1(621)	0.9
	80/20	89.0(614)	85.9(592)	3.5
	92/8	83.3(574)	77.4(534)	7.1
	99/1	75.5(521)	74.1(511)	1.8
	30/70	87.6(604)	84.3(581)	3.8
	20/80	83.4(575)	78.4(541)	6
	10.90	76.9(530)	72.3(498)	6
	1/99	67.7(467)	67.8(467)	0.1
	143aE/HFC-32			
	6.2/98.8	247.4(1707)	247.4(1707)	0.0
	1/99	246.9(1703)	246.9(1703)	0.0
	20/80	245.1(1691)	243.9(1682)	0.5
	30/70	241.4(1665)	237.3(1637)	1.7
	40/60	236.1(1629)	226.9(1565)	3.9
	50/50	228.8(1578)	210.9(1455)	7.8
	55/45	224(1545)	200.1(1380)	10.6
	54/46	225(1552)	202(1393)	10.0
	143aE/HFC-134			
	99.0/1.0	127.5 (879)	127.5 (879)	0
	92.4/7.6	127.6 (880)	127.6 (880)	0
	30.0/70.0	123.4 (851)	123.1 (849)	0.2
	1.0/99.0	118.3 (815)	118.2 (815)	0
	143aE/HFC-143a			
	8.7/91.3	182.1(1256)	182.1(1256)	0.0
	1/99	181.0(1248)	181.0(1248)	0.0
	20/80	180.5(1245)	179.7(1239)	0.4

40/50	172.4(1189)	165.0(1138)	4.3
55/45	161.8(1116)	144.7(998)	10.6
54/46	162.7(1122)	146.3(1009)	10.1
53/47	163.5(1128)	147.9(1020)	9.5
143aE/HFC-152a			
48.6/51.4	87.4(603)	87.4(603)	0.0
40/60	87.3(602)	87.3(602)	0.0
30/70	87.2(601)	87.1(601)	0.1
10/90	86.3(595)	86.3(595)	0.0
1/99	85.8(592)	85.8(592)	0.0
60/40	87.2(601)	87.2(601)	0.0
70/30	86.9(599)	86.8(598)	0.1
90/10	85.2(587)	85.2(587)	0.0
99/1	84.0(579)	84.0(579)	0.0
143aE/HFC-227ca			
71.5/28.5	85.9(592)	85.9(592)	0.0
80/20	85.7(591)	85.7(591)	0.0
99/1	84.0(579)	84.0(579)	0.0
60/40	85.6(590)	85.4(589)	0.2
40/60	83.2(574)	82.1(566)	1.3
30/70	80.8(557)	78.9(544)	2.3
20/80	77.2(532)	74.5(514)	3.5
1/99	64.7(446)	64.3(443)	0.6
143aE/HFC-227ea			
75.6/24.4	84.9(585)	84.9(585)	0.0
90/10	84.5(583)	84.5(583)	0.0
99/1	83.9(578)	83.9(578)	0.0
70/30	84.8(585)	84.8(585)	0.0
60/40	84.4(582)	84.3(581)	0.1
50/50	83.6(576)	83.2(574)	0.5
30/70	80.1(552)	78.9(544)	1.5
10/90	72.8(502)	71.3(492)	2.1
1/99	67.3(464)	67.1(463)	0.3
143aE/HFC-245cb			
59.6/40.4	102.8(709)	102.8(709)	0.0
70/30	102.2(705)	101.5(700)	0.7
80/20	100.5(693)	96.9(668)	3.6
99/1	85.8(592)	84.0(579)	2.1
40/60	100.7(694)	98.2(677)	2.5
30/70	97.4(672)	91.6(632)	6.0
20/80	91.8(633)	82.7(570)	9.9
19/81	91.0(627)	81.7(563)	10.2

C-216E/HFC-134			
1.0/99.0	76.9 (530)	76.3 (526)	0.8
50.0/50.0	100.1 (690)	98.0 (676)	2.1
79.8/20.2	104.4 (720)	104.4 (720)	0
99.0/1.0	100.8 (695)	100.7 (694)	0.1
C216E/HFC-134a			
61.7/38.3	108.0(745)	108.0(745)	0.0
80/20	106.6(735)	106.4(734)	0.2
90/10	104.4(720)	105.0(724)	0.6
99/1	100.8(695)	100.7(694)	0.1
50/50	107.6(742)	107.4(741)	0.1
30/70	105.2(725)	104.6(721)	0.2
10/90	101.0(696)	100.4(692)	0.5
1/99	98.6(680)	98.5(679)	0.1
C216E/HFC-143			
99.0/1.0	101.2 (698)	101.0 (696)	0.2
91.9/8.1	103.5 (714)	103.5 (714)	0
61.0/39.0	96.6 (666)	87.3 (602)	9.6
C216E/HFC-152a			
77.6/22.4	109.1(752)	109.1(752)	0.0
90/10	107.2(739)	106.7(736)	0.5
99/1	101.4(699)	101.1(697)	0.3
70/30	108.7(759)	108.5(748)	0.2
60/40	107.2(739)	106.2(732)	0.9
30/70	99.2(684)	94.8(654)	4.4
20/80	95.4(658)	91.0(627)	4.6
10/90	91.0(627)	87.9(606)	3.4
1/99	86.3(595)	86.0(593)	0.3
C216E/HFC-161			
58.8/41.2	148.3(1023)	148.3(1023)	0.0
70/30	147.2(1015)	146.3(1009)	0.6
80/20	143.3(988)	139.1(959)	2.9
99/1	105.4(727)	102.2(705)	3.0
50/50	147.8(1019)	147.4(1017)	0.3
40/60	146.4(1010)	144.7(998)	1.2
30/70	144.1(994)	140.6(970)	2.4
20/80	140.8(971)	136.3(940)	3.2
1/99	130.9(903)	130.4(899)	0.4
C216E/HFC-245cb			
95.1/4.9	100.6(694)	100.6(694)	0.0
99/1	100.4(692)	100.4(692)	0.0
70/30	96.9(668)	95.6(659)	1.3

	60/40	94.1(694)	91.8(633)	2.4
	50/50	90.8(626)	87.4(603)	3.7
	40/60	87.0(600)	87.9(606)	1.0
	30/70	82.8(571)	78.3(540)	5.4
	20/80	78.0(538)	74.1(511)	5.0
	1/99	68.0(469)	68.0(469)	0.0
	C-216E2/HFC-32			
	36.0/64.0	272.4 (1878)	272.4 (1878)	0.0
	15.0/85.0	269.3 (1857)	256.1 (1766)	4.9
	1.0/99.0	250.4 (1726)	246.8 (1702)	1.4
	60.0/40.0	269.3 (1857)	261.3 (1802)	3.0
	80.0/20.0	250.6 (1728)	179.7 (1239)	28.3
	70.0/30.0	263.9 (1820)	238.7 (1646)	9.5
	71.0/29.0	263.0 (1813)	235.0 (1620)	10.6
	C-216E2/HFC-134			
	60.5/39.5	88.6 (611)	88.6 (611)	0.0
	80.0/20.0	86.7 (598)	85.9 (592)	0.9
	99.0/1.0	77.6 (535)	77.3 (533)	0.4
	40.0/60.0	87.2 (601)	86.4 (596)	0.9
	20.0/80.0	83.2 (574)	81.4 (561)	2.2
	1.0/99.0	76.5 (527)	76.3 (526)	0.3
	C-216E2/HFC-134a			
	20.6/79.4	99.0 (683)	99.0 (683)	0.0
	1.0/99.0	98.3 (678)	98.3 (678)	0.0
	50.0/50.0	97.2 (670)	96.8 (667)	0.4
	80.0/20.0	89.6 (618)	87.6 (604)	2.2
	99.0/1.0	77.6 (535)	77.3 (533)	0.4
	C-216E2/HFC-143			
	87.1/12.9	82.9 (572)	82.9 (572)	0.0
	99.0/1.0	78.1 (538)	77.5 (534)	0.8
	50.0/50.0	77.2 (532)	55.6 (383)	28.0
	70.0/30.0	80.8 (557)	78.5 (541)	2.8
	60.0/40.0	79.0 (545)	73.1 (504)	7.5
	58.0/42.0	78.7 (543)	71.2 (491)	9.5
	57.0/43.0	78.5 (541)	70.1 (483)	10.7
	C-216E2/HFC-152a			
	60.5/39.5	95.6 (659)	95.6 (659)	0.0
	80.0/20.0	93.2 (643)	92.1 (635)	1.2
	99.0/1.0	78.4 (541)	77.7 (536)	0.9
	40.0/60.0	94.2 (649)	93.5 (645)	0.7
	20.0/80.0	90.9 (627)	89.5 (617)	1.5
	1.0/99.0	86.1 (594)	85.9 (592)	0.2

	C-216E2/HFC-161			
	45.7/54.3	138.3 (954)	138.3 (954)	0.0
	20.0/80.0	135.8 (936)	134.6 (928)	0.9
	1.0/99.0	130.6 (900)	130.4 (899)	0.2
	60.0/40.0	137.3 (947)	136.4 (940)	0.7
	80.0/20.0	129.0 (889)	120.3 (829)	6.7
	85.0/15.0	123.7 (853)	111.0 (765)	10.3
	84.0/16.0	124.9 (861)	113.1 (780)	9.4
	C-216E2/HFC-245cb			
	74.7/25.3	81.3 (561)	81.3 (561)	0.0
	99.0/1.0	77.2 (532)	77.1 (532)	0.1
	50.0/50.0	79.3 (547)	78.6 (542)	0.9
	20.0/80.0	73.1 (504)	71.8 (495)	1.8
	1.0/99.0	67.7 (467)	67.6 (466)	0.1
	218E/HFC-134			
	99.0/1.0	87.3 (602)	84.7 (584)	3.0
	80.0/20.0	113.8 (785)	109.9 (758)	3.4
	63.3/36.7	116.6 (804)	116.6 (804)	0
	50.0/50.0	115.8 (798)	114.5 (789)	1.1
	35.0/65.0	113.5 (783)	102.7 (708)	9.5
	218E/HFC-134a			
	53.0/47.0	122.3(843)	122.3(843)	0.0
	70/30	120.2(829)	117.8(812)	2.0
	80/20	115.6(797)	109.1(752)	5.6
	99/1	86.8(598)	84.7(584)	2.4
	40/60	121.5(838)	120.3(830)	1.0
	30/70	119.6(825)	115.6(797)	3.3
	20/80	116.3(802)	108.0(745)	7.1
	1/99	99.9(689)	98.4(679)	1.5
	218E/HFC-143			
	99.0/1.0	90.6 (625)	84.5 (583)	6.7
	85.3/14.7	103.7 (715)	103.7 (715)	0
	57.0/43.0	102.4 (706)	99.0 (683)	3.3
	218E/HFC-152a			
	68.2/31.8	124.0(855)	124.0(855)	0.0
	80/20	112.4(775)	120.0(828)	6.8
	99/1	89.5(617)	85.1(587)	4.9
	60/40	123.6(852)	123.0(848)	0.5
	50/50	122.6(845)	119.5(824)	2.5
	40/60	121.0(834)	108.5(748)	10.3
	41/59	121.2(836)	110.3(761)	9.0

218E/HFC-161			
62.6/37.4	170.9(1179)	170.9(1179)	0.0
80/20	167.8(1157)	160.2(1105)	4.5
85/15	163.8(1130)	146.4(1010)	10.6
84/16	164.9(1137)	149.9(1034)	9.1
60/40	170.9(1179)	170.8(1178)	0.5
38/62	169.4(1168)	152.3(1050)	10.1
39/61	169.5(1169)	156.5(1079)	7.7
218E/HFC-263fb			
96.3/3.7	84.0(579)	84.0(579)	0.0
99/1	83.9(578)	83.9(578)	0.0
70/30	80.0(552)	78.5(541)	1.9
40/60	71.6(494)	66.1(456)	7.7
23/77	65.4(451)	59.1(407)	9.6
24/76	65.8(454)	59.4(409)	9.7
25/75	66.2(456)	60.2(415)	9.6
10/90	59.5(410)	55.5(383)	6.7
1/99	54.6(376)	54.1(373)	0.9
218E2/HFC-134			
1.0/99.0	77.1 (532)	76.2 (525)	1.2
20.0/80.0	86.9 (599)	83.1 (573)	4.4
36.1/53.9	89.6 (618)	89.6 (618)	0
70.0/30.0	86.8 (598)	83.0 (572)	4.4
79.0/21.0	83.0 (572)	74.8 (516)	9.9
218E2/HFC-134a			
24.7/75.3	101.1(697)	101.1(697)	0.0
10/90	100.2(691)	99.9(689)	0.3
1/99	98.5(679)	98.4(679)	0.1
40/60	100.2(691)	99.6(687)	0.6
50/50	98.7(681)	96.8(667)	1.9
70/30	92.0(634)	84.1(580)	8.6
73/27	90.2(622)	81.1(559)	10.1
72/28	90.8(626)	82.1(566)	9.6
218E2/HFC-143			
91.0/9.0	70.7 (487)	65.0 (448)	8.1
78.3/21.7	72.6 (501)	72.6 (501)	0
52.0/48.0	71.8 (495)	67.5 (465)	6.0
218E2/HFC-152a			
51.0/49.0	98.1(676)	98.1(676)	0.0
70/30	96.4(665)	93.9(647)	2.6
82/18	91.3(630)	82.0(565)	10.2

	81/19	92.0(634)	83.5(576)	9.2
	40/60	97.7(674)	97.1(670)	0.6
	30/70	96.7(667)	94.5(652)	2.3
	20/80	94.8(654)	90.5(624)	4.5
	10/90	91.5(631)	87.3(602)	4.6
	1/99	86.5(596)	85.9(592)	0.7
	218E2/HFC-161			
	46.4/53.6	145.1(1001)	145.1(1001)	0.0
	60/40	144.4(996)	143.2(988)	0.8
	77/23	139.4(961)	126.7(874)	9.1
	78/22	138.8(957)	124.5(859)	10.3
	40/60	145.0(1000)	144.7(998)	0.2
	30/70	144.3(995)	142.0(979)	1.6
	20/80	142.7(984)	135.6(935)	5.0
	10/90	139.1(959)	131.3(906)	5.6
	1/99	131.5(907)	130.2(898)	1.0
	218E2/HFC-236fa			
	89.8/10.2	52.6(362)	52.6(362)	0.0
	99/1	52.3(360)	52.4(361)	0.2
	70/30	51.8(357)	51.6(356)	0.4
	60/40	50.8(350)	50.3(347)	1.0
	50/50	49.7(342)	48.8(336)	1.8
	30/70	46.6(321)	44.9(309)	3.6
	20/80	44.6(307)	42.9(296)	3.8
	10/90	42.2(291)	41.0(282)	2.8
	1/99	39.7(273)	39.5(272)	0.5
	218E2/HFC-263fb			
	60.5/39.5	57.9(399)	57.9(399)	0.0
	70/30	57.7(398)	57.7(398)	0.0
	90/10	55.4(382)	55.1(380)	0.5
	99/1	52.7(363)	52.6(362)	0.2
	50/50	57.7(398)	57.7(398)	0.0
	30/70	56.7(391)	56.5(389)	0.4
	20/80	56.0(386)	56.0(386)	0.0
	10/90	55.0(379)	54.8(378)	0.4
	1/99	54.1(373)	54.1(373)	0.0
	C-225eE$\alpha\beta$ /HFC-143			
	55.9/44.1	38.0 (262)	38.0 (262)	0.0
	80.0/20.0	36.7 (253)	36.1 (249)	1.6
	99.0/1.0	31.6 (218)	31.4 (216)	0.6
	20.0/80.0	36.1 (249)	35.4 (244)	1.9
	1.0/99.0	33.3 (230)	33.2 (229(	0.3

C-225eEαβ /HFC-236cb				
	16.7/83.3	33.7 (232)	33.7 (232)	0.0
	1.0/99.0	33.6 (232)	33.6 (232)	0.0
	50.0/50.0	33.3 (230)	33.3 (230)	0.0
	80.0/20.0	32.3 (223)	32.2 (222)	0.3
	99.0/1.0	31.2 (215)	31.2 (215)	0.0
C-225eEαβ /HFC-236ea				
	91.5/8.5	31.1 (214)	31.1 (214)	0.0
	99.0/1.0	31.1 (214)	31.1 (214)	0.0
	60.0/40.0	30.8 (212)	30.8 (212)	0.0
	40.0/60.0	30.4 (210)	30.3 (209)	0.3
	20.0/80.0	29.7 (205)	29.6 (204)	0.3
	1.0/99.0	28.8 (199)	28.8 (199)	0.0
C-225eEαβ /HFC-245cb				
	22.4/77.6	70.1 (483)	70.1 (483)	0.0
	1.0/99.0	67.7 (467)	67.6 (466)	0.1
	50.0/50.0	67.7 (467)	65.7 (453)	3.0
	60.0/40.0	66.0 (455)	61.7 (425)	6.5
	65.0/35.0	65.0 (448)	58.5 (403)	10.0
227caEαβ /HFC-32				
	17.9/82.1	253.4(1748)	253.4(1748)	0.0
	10/90	252.8(1744)	251.8(1737)	0.4
	1/99	247.9(1710)	247.1(1705)	0.3
	40/60	251.3(1734)	248.0(1711)	1.3
	60/40	244.7(1688)	223.4(1541)	8.7
	61/39	244.0(1683)	221.0(1524)	9.4
	62/38	243.4(1679)	218.2(1505)	10.4
227caEαβ /HFC-143				
	99.0/1.0	43.0 (296)	41.8 (288)	2.8
	95.0/5.0	47.6 (328)	44.4 (306)	6.7
	70.9/29.1	53.7 (370)	53.7 (370)	0
	42.0/58.0	52.0 (359)	46.9 (323)	9.8
227caEαβ /HFC-245cb				
	8.1/91.9	67.5(465)	67.5(465)	0.0
	1/99	67.4(465)	67.4(465)	0.0
	30/70	66.7(460)	66.5(458)	0.3
	50/50	64.5(445)	63.4(437)	1.7
	70/30	60.2(415)	56.8(391)	5.6
	77/23	57.9(399)	53.2(367)	8.1
	80/20	56.6(390)	51.5(355)	9.0
	82/18	55.8(385)	50.3(347)	9.8
	83/17	55.3(381)	49.7(342)	10.1

227caEαβ/HFC-272ca			
94.3/5.7	41.4(285)	41.4(285)	0.0
99/1	41.4(285)	41.4(285)	0.0
80/20	41.0(282)	41.0(282)	0.0
60/40	39.7(273)	39.4(271)	0.8
40/60	38.1(262)	37.6(259)	1.3
20/80	36.4(251)	35.9(247)	1.4
10/90	35.5(245)	35.2(242)	0.8
1/99	34.6(238)	34.6(238)	0.0
227caEαβ/HFC-281ea			
31.5/68.5	47.4(327)	47.4(327)	0.0
20/80	47.3(326)	47.3(326)	0.0
10/90	47.2(325)	47.2(325)	0.0
1/99	47.1(325)	47.1(325)	0.0
50/50	47.2(325)	47.2(325)	0.0
70/30	46.5(320)	46.4(320)	0.2
90/10	44.2(305)	43.9(302)	0.7
99/1	41.7(287)	41.6(287)	0.2
227caEαβ/HFC-281fa			
84.3/15.7	42.4(292)	42.4(292)	0.0
90/10	42.3(291)	42.3(291)	0.0
99/1	41.5(286)	41.5(286)	0.0
60/40	41.6(287)	41.4(285)	0.5
40/60	40.3(278)	40.0(276)	0.7
20/80	39.0(269)	38.7(267)	0.8
10/90	38.4(265)	38.2(263)	0.5
1/99	37.8(260)	37.8(260)	0.0
227caEβγ/HFC-32			
28.4/71.6	269.7(1860)	269.7(1860)	0.0
10/90	268.6(1853)	247.0(1704)	8.0
1/99	255.3(1761)	246.7(1702)	3.4
40/60	269.4(1858)	268.8(1854)	0.2
60/40	266.6(1839)	255.3(1761)	4.2
67/33	263.7(1819)	238.6(1646)	9.5
68/32	263.1(1815)	235.0(1621)	10.6
227caEβγ/HFC-134			
34.8/65.2	82.7 (571)	82.7 (571)	0.0
10/90	80.0 (552)	78.7 (543)	1.6
5/95	78.4 (541)	77.3 (533)	1.4
1/99	76.6 (529)	76.3 (527)	0.0
50/50	81.9 (565)	81.1 (560)	1.0
60/40	80.3 (554)	77.8 (537)	3.1

	70/30	77.3 (533)	72.2 (498)	6.6
	77/23	74.1 (511)	66.7 (460)	10.0
	76/24	74.6 (515)	67.6 (466)	9.4
	227caEβγ/HFC-134a			
	1.9/98.1	98.3(678)	98.3(678)	0.0
	1/99	98.3(678)	98.3(678)	0.0
	20/80	97.2(670)	96.9(668)	0.3
	30/70	95.8(661)	94.8(654)	1.0
	50/50	91.0(627)	87.1(601)	4.3
	68/32	83.3(574)	74.8(516)	10.2
	67/33	83.8(578)	75.6(521)	9.8
	227caEβγ/HFC-143			
	91.0/9.0	63.1 (435)	57.4 (396)	9.0
	73.8/26.2	66.2 (456)	66.2 (456)	0
	46.0/54.0	65.1 (449)	59.1 (407)	9.2
	227caEβγ/HFC-152a			
	38.3/61.7	91.4(630)	91.4(630)	0.0
	20/80	90.4(623)	89.6(618)	0.9
	10/90	88.7(612)	87.6(604)	1.2
	1/99	86.1(594)	85.9(592)	0.2
	60/40	89.8(619)	88.0(607)	2.0
	70/30	87.2(601)	82.7(570)	5.2
	80/20	82.1(566)	73.1(504)	11
	78/22	83.4(575)	75.4(520)	9.6
	79/21	82.8(571)	74.3(512)	10.2
	227caEβγ/HFC-161			
	34.4/65.6	137.5(948)	137.5(948)	0.0
	20/80	136.7(943)	135.6(935)	0.8
	10/90	134.7(929)	132.6(914)	1.6
	1/99	130.8(902)	130.4(899)	0.3
	40/60	134.4(927)	137.3(947)	2.2
	60/40	135.0(931)	131.0(903)	3.0
	72/28	130.2(898)	117.8(812)	9.5
	73/27	129.6(894)	116.0(800)	10.4
	227caEβγ/HFC-263fb			
	32.9/67.1	54.6(376)	54.6(376)	0.0
	20/80	54.5(376)	54.5(376)	0.0
	10/90	54.3(374)	54.3(374)	0.0
	1/99	54.0(372)	54.0(372)	0.0
	50/50	54.4(375)	54.4(375)	0.0
	70/30	53.4(368)	53.2(367)	0.4
	90/10	50.9(351)	50.7(349)	0.4

	99/1	49.0(338)	48.9(337)	0.2
	227caEβγ/HFC-272ca			
	89.0/11.0	49.6(342)	49.6(342)	0.0
	99/1	48.9(337)	48.9(337)	0.0
	60/40	47.1(325)	46.0(317)	2.3
	40/60	44.1(304)	41.3(285)	6.3
	30/70	42.2(291)	38.9(268)	7.8
	20/80	40.1(276)	36.9(254)	8.0
	10/90	37.6(259)	35.4(244)	5.9
	1/99	34.8(240)	34.6(238)	0.6
	80/20	49.3(340)	49.2(339)	0.2
	227caEβγ/HFC-281ea			
	73.1/26.9	54.0(372)	54.0(372)	0.0
	80/20	53.8(371)	53.8(371)	0.0
	90/10	52.6(362)	52.3(360)	0.0
	99/1	49.3(340)	49.2(339)	0.6
	60/40	53.4(368)	53.4(368)	0.2
	40/60	52.0(358)	51.4(354)	0.0
	30/70	51.0(351)	50.1(345)	1.8
	10/90	48.6(335)	48.0(331)	1.2
	1/99	47.3(326)	47.2(325)	0.2
	227caEβγ/HFC-281fa			
	85.9/14.1	51.0(351)	51.0(351)	0.0
	90/10	50.9(351)	50.9(351)	0.0
	99/1	49.1(338)	49.1(338)	0.0
	70/30	50.0(345)	49.5(341)	1.0
	40/60	45.9(316)	43.3(298)	5.7
	30/70	44.2(305)	41.2(284)	6.8
	20/80	42.3(291)	39.6(273)	6.4
	10/90	40.1(276)	38.5(265)	4.0
	1/99	38.0(262)	37.8(260)	0.5
	227eaE/HFC-32			
	30.0/70.0	272.3(1878)	272.3(1878)	0.0
	20/80	272.1(1877)	270.9(1869)	0.4
	10/90	271.2(1871)	246.7(1702)	9.0
	1/99	257.1(1774)	246.7(1702)	4.0
	50/50	271.4(1872)	268.6(1853)	1.0
	60/40	269.6(1860)	259.6(1791)	3.7
	68/32	266.4(1838)	240.8(1661)	9.6
	69/31	265.8(1834)	237.1(1636)	10.8
	227eaE/HFC-134			
	1.0/99.0	76.7 (529)	76.3 (526)	0.5

	10.0/90.0	80.9 (558)	78.9 (544)	2.5
	38.2/61.8	84.7 (584)	84.7 (584)	0
	60.0/40.0	82.7 (570)	80.7 (556)	2.4
	78.0/22.0	76.4 (527)	69.1 (476)	9.6
	227eaE/HFC-134a			
	9.3/90.7	98.6(680)	98.6(680)	0.0
	1/99	98.3(678)	98.3(678)	0.0
	30/70	97.2(670)	96.5(665)	0.7
	40/60	95.5(659)	93.8(647)	1.8
	60/40	89.6(618)	83.9(578)	6.4
	70/30	84.6(583)	76.2(525)	9.0
	71/29	84.0(579)	75.3(519)	10.4
	227eaE/HFC-143			
	92.0/8.0	65.4 (451)	59.1 (408)	9.6
	74.9/25.1	68.9 (475)	68.9 (475)	0.0
	47.0/53.0	67.7 (469)	61.7 (426)	8.9
	80.0/20.0	68.8 (475)	68.4 (472)	0.6
	93.0/7.0	64.6 (451)	57.7 (398)	10.7
	60.0/40.0	68.4 (446)	67.6 (466)	1.2
	50.0/50.0	67.9 (472)	65.2 (450)	4.0
	46.0/54.0	67.7 (474)	59.0 (407)	12.8
	227eaE/HFC-152a			
	42.1/57.9	93.2(643)	93.2(643)	0.0
	20/80	91.6(632)	90.3(623)	1.4
	10/90	89.4(616)	87.8(605)	1.8
	1/99	86.2(594)	85.9(592)	0.3
	60/40	92.0(634)	90.7(625)	1.4
	70/30	89.7(618)	85.8(592)	4.3
	80/20	84.9(585)	76.5(527)	9.9
	81/19	84.2(581)	75.2(518)	10.7
	30/70	92.8(640)	92.3(636)	0.5
	227eaE/HFC-161			
	37.5/62.5	139.5(962)	139.5(962)	0.0
	20/80	138.3(954)	136.4(941)	1.4
	10/90	135.8(937)	132.6(914)	2.4
	1/99	131.0(903)	130.3(899)	0.5
	60/40	137.5(948)	134.2(926)	2.4
	70/30	134.2(926)	124.8(866)	7.0
	73/27	132.6(914)	120.1(828)	9.4
	74/26	131.9(910)	118.3(816)	10.3
	30/70	139.3(961)	139.0(959)	0.2
	227eaE/HFC-263fb			

	49.3/50.7	55.7(384)	55.7(384)	0.0
	30/70	55.4(382)	55.3(381)	0.2
	20/80	55.0(379)	55.0(379)	0.0
	10/90	54.6(376)	54.5(376)	0.2
	1/99	54.1(373)	54.0(372)	0.2
	70/30	55.2(380)	55.1(380)	0.2
	80/20	54.4(375)	54.3(374)	0.2
	90/10	53.2(367)	53.0(365)	0.4
	99/1	51.5(355)	51.5(355)	0.0
	227eaE/HFC-272ca			
	90.7/9.3	52.0(358)	52.0(358)	0.0
	99/1	51.4(354)	51.4(354)	0.0
	70/30	50.3(347)	49.6(342)	1.4
	50/50	47.3(326)	44.7(308)	5.5
	35/65	44.5(307)	40.4(278)	9.2
	30/70	43.4(299)	39.1(269)	9.9
	29/71	43.2(298)	38.8(267)	10.2
	80/20	51.4(354)	51.2(353)	0.4
	227eaE/HFC-281ea			
	76.8/23.2	55.9(385)	55.9(385)	0.0
	90/10	54.9(378)	54.7(377)	0.4
	99/1	51.8(357)	51.7(356)	0.2
	60/40	55.2(380)	54.8(378)	0.7
	40/60	53.2(367)	52.1(359)	2.1
	30/70	51.9(358)	50.6(349)	2.5
	20/80	50.4(347)	49.2(339)	2.4
	10/90	48.9(337)	48.1(331)	1.6
	1/99	47.3(326)	47.2(325)	0.2
	227eaE/HFC-281fa			
	87.6/12.4	53.3(367)	53.3(367)	0.0
	99/1	51.7(356)	51.6(356)	0.2
	60/40	50.5(348)	48.9(337)	3.2
	40/60	47.2(325)	43.7(301)	7.4
	30/70	45.2(311)	41.4(285)	8.4
	20/80	43.0(296)	39.6(273)	7.9
	10/90	40.5(279)	38.4(265)	5.2
	1/99	38.0(262)	37.8(260)	0.5
	70/30	51.9(358)	51.2(353)	1.3
	C-234fE$\alpha\beta$ /HFC-245cb			
	13.5/86.5	69.9 (482)	69.9 (482)	0.0
	1.0/99.0	67.9 (468)	67.7 (467)	0.3
	40.0/60.0	67.6 (466)	65.6 (452)	3.0
	50.0/50.0	66.4 (458)	63.6 (439)	4.2

	55.0/45.0	65.9 (454)	62.0 (427)	5.9
	57.0/43.0	65.7 (453)	60.7 (419)	7.6
	58.0/42.0	65.6 (452)	59.5 (410)	9.3
	59.0/41.0	65.5 (452)	57.5 (396)	12.2
	C-234fE$\alpha\beta$ /HFC-245eb			
	49.1/50.9	17.6 (121)	17.6 (121)	0.0
	20.0/80.0	17.3 (119)	17.3 (119)	0.0
	1.0/99.0	16.9 (117)	16.9 (117)	0.0
	80.0/20.0	17.3 (119)	17.3 (119)	0.0
	99.0/1.0	16.8 (116)	16.8 (116)	0.0
	C-234fE$\alpha\beta$ /HFC-356mff			
	59.0/41.0	18.8 (130)	18.8 (130)	0.0
	80.0/20.0	18.4 (127)	18.2 (125)	1.1
	99.0/1.0	16.9 (117)	16.8 (116)	0.6
	40.0/60.0	18.5 (128)	18.3 (126)	1.1
	20.0/80.0	17.3 (119)	16.8 (116)	2.9
	10.0/90.0	16.2 (112)	15.7 (108)	3.1
	1.0/99.0	14.8 (102)	14.8 (102)	0.0
	C-234fE$\alpha\beta$ /HFC-356mmz			
	50.1/49.9	20.1 (139)	20.1 (139)	0.0
	20.0/80.0	19.1 (132)	18.7 (129)	2.1
	1.0/99.0	16.8 (116)	16.7 (115)	0.6
	80.0/20.0	19.2 (132)	18.7 (129)	2.6
	99..0/1.0	16.9 (117)	16.8 (116)	0.6
	C-234fE$\beta\gamma$ /HFC-245cb			
	10.2/89.8	69.1 (476)	69.1 (476)	0.0
	1.0/99.0	67.8 (467)	67.7 (467)	0.1
	40.0/60.0	66.4 (458)	64.4 (444)	3.0
	50.0/50.0	65.4 (451)	62.7 (432)	4.1
	55.0/45.0	65.0 (448)	61.0 (421)	6.2
	58.0/42.0	64.7 (446)	52.6 (363)	18.7
	57.0/43.0	64.8 (447)	57.9 (399)	10.6
	56.0/44.0	64.9 (447)	60.0 (414)	7.6
	C-234fE$\beta\gamma$ /HFC-245ca			
	33.6/66.4	14.5 (100)	14.5 (100)	0.0
	15.0/85.0	14.4 (99)	14.4 (99)	0.0
	1.0/99.0	14.2 (98)	14.2 (98)	0.0
	60.0/40.0	14.3 (99)	14.3 (99)	0.0
	80.0/20.0	13.9 (96)	13.9 (96)	0.0
	99.0/ 1.0	13.3 (92)	13.3 (92)	0.0
	C-234fE$\beta\gamma$ /HFC-245ea			

	36.0/64.0	14.5 (100)	14.5 (100)	0.0
	15.0/85.0	14.4 (99)	14.4 (99)	0.0
	1.0/99.0	14.2 (98)	14.2 (98)	0.0
	60.0/40.0	14.4 (99)	14.3 (99)	0.7
	80.0/20.0	14.0 (97)	13.9 (96)	0.7
	99.0/ 1.0	13.3 (92)	13.3 (92)	0.0
	C-234fEβγ/HFC-254ca			
	36.0/64.0	13.8 (95)	13.8 (95)	0.0
	15.0/85.0	13.8 (95)	13.8 (95)	0.0
	1.0/99.0	13.7 (94)	13.7 (94)	0.0
	60.0/40.0	13.8 (95)	13.8 (95)	0.0
	80.0/20.0	13.6 (94)	13.6 (94)	0.0
	99.0/ 1.0	13.3 (92)	13.3 (92)	0.0
	C-234fEβγ/HFC-356mff			
	43.1/56.9	17.1 (118)	17.1 (118)	0.0
	20.0/80.0	16.5 (114)	16.3 (112)	1.2
	1.0/99.0	14.8 (102)	14.8 (102)	0.0
	70.0/30.0	16.5 (114)	16.0 (110)	3.0
	90.0/10.0	15.0 (103)	14.0 (97)	6.7
	99.0/1.0	13.5 (93)	13.3 (92)	1.5
	C-234fEβγ/HFC-356mmz			
	35.8/64.2	18.6 (128)	18.6 (128)	0.0
	15.0/85.0	18.0 (124)	17.8 (123)	1.1
	1.0/99.0	16.7 (115)	16.7 (115)	0.0
	60.0/40.0	18.1 (125)	17.6 (121)	2.8
	80.0/20.0	16.8 (116)	15.3 (105)	8.9
	85.0/15.0	16.2 (112)	14.5 (100)	10.5
	83.0/17.0	16.5 (114)	14.8 (102)	10.3
	82.0/18.0	16.6 (114)	15.0 (103)	9.6
	236caE/HFC-143			
	60.0/40.0	30.4 (210)	27.4 (189)	9.9
	12.0/88.0	33.4 (230)	33.4 (231)	0.0
	10.0/90.0	33.4 (230)	33.4 (230)	0.0
	1.0/99.0	33.1 (228)	33.1 (228)	0.0
	5.0/95.0	33.3 (230)	33.3 (230)	0.0
	30.0/70.0	33.0 (228)	33.0 (228)	0.0
	40.0/60.0	32.4 (224)	31.7 (219)	2.2
	61.0/39.0	30.3 (209)	27.1 (187)10.6	
	236caE/HFC-245ca			
	1.0/99.0	14.2 (98)	14.2 (98)	0.0
	10.0/90.0	14.1 (97)	14.1 (97)	0.0
	20.0/80.0	14.0 (97)	14.0 (97)	0.0
	30.0/70.0	13.9 (96)	13.9 (96)	0.0

	40.0/60.0	13.8 (95)	13.7 (94)	0.7
	50.0/50.0	13.6 (94)	13.6 (94)	0.0
	60.0/40.0	13.5 (93)	13.4 (92)	0.7
	70.0/30.0	13.3 (92)	13.3 (92)	0.0
	80.0/20.0	13.2 (91)	13.2 (91)	0.0
	90.0/10.0	13.1 (90)	13.0 (90)	0.8
	99.0/1.0	12.9 (89)	12.9 (89)	0.0
	236caE/HFC-254ca			
	17.6/82.4	13.7(94)	13.7(94)	0.0
	10/90	13.7(94)	13.7(94)	0.0
	1/99	13.7(94)	13.7(94)	0.0
	30/70	13.7(94)	13.7(94)	0.0
	50/50	13.6(93)	13.6(93)	0.0
	70/30	13.4(92)	13.4(92)	0.0
	90/10	13.1(90)	13.1(90)	0.0
	99/1	13.0(89)	13.0(89)	0.0
	40/60	13.7(94)	13.7(94)	0.0
	236eaE$\beta\gamma$/HFC-143			
	66.0/34.0	32.1 (221)	29.1 (201)	9.3
	25.9/74.1	34.6 (239)	34.6 (239)	0
	10.0/90.0	34.1 (235)	33.9 (234)	0.6
	1.0/99.0	33.2 (229)	33.2 (229)	0
	236eaE$\beta\gamma$/HFC-245ca			
	1.0/99.0	14.7 (101)	14.7 (101)	0.0
	10.0/90.0	15.0 (103)	15.0 (103)	0.0
	20.0/80.0	15.4 (106)	15.3 (105)	0.6
	30.0/70.0	15.6 (108)	15.6 (108)	0.0
	40.0/60.0	15.8 (109)	15.8 (109)	0.0
	50.0/50.0	16.0 (110)	16.0 (110)	0.0
	60.0/40.0	16.1 (111)	16.1 (111)	0.0
	69.1/30.9	16.1 (111)	16.1 (111)	0.0
	80.0/20.0	16.1 (111)	16.1 (111)	0.0
	90.0/10.0	15.9 (110)	15.9 (110)	0.0
	99.0/1.0	15.7 (108)	15.7 (108)	0.0
	236eaE$\beta\gamma$/HFC-263ca			
	4.1/95.9	18.2(125)	18.2(125)	0.0
	1/99	18.2(125)	18.2(125)	0.0
	30/70	18.1(124)	18.1(124)	0.0
	50/50	17.9(123)	17.8(122)	0.6
	70/30	17.3(119)	17.2(118)	0.6
	90/10	16.4(113)	16.3(112)	0.6
	99/1	15.8(109)	15.8(109)	0.0

	236eaEβγ/HFC-338mf			
	92.6/7.4	16.2(111)	16.1(111)	0.6
	99/1	15.8(109)	15.7(108)	0.6
	70/30	17.4(120)	17.2(118)	1.1
	50/50	18.1(124)	18.0(124)	0.6
	40/60	18.4(127)	18.4(127)	0.0
	30/70	18.6(128)	18.6(128)	0.0
	10/90	18.8(129)	18.8(129)	0.0
	1/99	18.8(129)	18.8(129)	0.0
	236eaEβγ/HFC-356mff			
	1.0/99.0	14.9 (103)	14.9 (103)	0.0
	10.0/90.0	15.1 (104)	15.1 (104)	0.0
	20.0/80.0	15.2 (105)	15.2 (105)	0.0
	30.0/70.0	15.3 (106)	15.3 (106)	0.0
	40.0/60.0	15.4 (106)	15.4 (106)	0.0
	50.0/50.0	15.5 (107)	15.5 (107)	0.0
	60.0/40.0	15.6 (108)	15.6 (108)	0.0
	70.0/30.0	15.6 (108)	15.6 (108)	0.0
	80.0/20.0	15.7 (108)	15.7 (108)	0.0
	90.0/10.0	15.7 (108)	15.7 (108)	0.0
	96.9/3.1	15.7 (108)	15.7 (108)	0.0
	99.0/1.0	15.7 (108)	15.7 (108)	0.0
	236eaEβγ/HFC-356mmz			
	15.1/84.9	16.6(114)	16.6(114)	0.0
	1/99	16.6(114)	16.6(114)	0.0
	30/70	16.6(114)	16.6(114)	0.0
	50/50	16.5(113)	16.5(113)	0.0
	70/30	16.2(111)	16.2(111)	0.0
	90/10	15.9(109)	15.9(109)	0.0
	99/1	15.7(108)	15.7(108)	0.0
	236faE/HFC-32			
	8.5/91.5	248.6(1715)	248.6(1715)	0.0
	1/99	247.2(1705)	247.0(1704)	0.1
	20/80	247.5(1707)	246.5(1700)	0.4
	40/60	243.5(1680)	236.4(1631)	2.9
	50/50	240.0(1656)	224.0(1545)	6.7
	55/45	237.3(1637)	213.8(1475)	9.9
	56/44	236.7(1633)	211.3(1458)	10.7

236faE/HFC-143				
	84.0/16.0	42.2 (291)	38.2 (264)	9.5
	56.9/43.1	45.1 (311)	45.1 (311)	0.0
	30.0/70.0	43.8 (302)	40.4 (279)	7.8
	28.0/72.0	43.6 (301)	39.5 (272)	9.4
	40.0/60.0	44.6 (308)	43.6 (301)	2.2
	27.0/73.0	43.5 (300)	39.0 (269)	10.3
	70.0/30.0	44.6 (308)	43.9 (303)	1.6
	80.0/20.0	43.2 (298)	40.5 (280)	6.3
	86.0/14.0	41.4 (286)	37.0 (255)	10.6
	85.0/15.0	41.8 (288)	37.6 (259)	10.0
236faE/HFC-272ca				
	27.8/72.2	34.8(240)	34.8(240)	0.0
	10/90	34.7(239)	34.7(239)	0.0
	1/99	34.5(238)	34.5(238)	0.0
	40/60	34.7(239)	34.7(239)	0.0
	60/40	34.2(236)	34.1(235)	0.3
	70/30	33.7(232)	33.5(231)	0.6
	90/10	31.6(218)	31.3(216)	0.9
	99/1	29.8(205)	29.8(205)	0.0
236faE/HFC-272fb				
	82.3/17.7	30.2(208)	30.2(208)	0.0
	99/1	29.7(204)	29.7(204)	0.0
	70/30	30.0(207)	30.0(207)	0.0
	50/50	29.3(202)	29.2(201)	0.3
	40/60	28.9(199)	28.6(197)	1.0
	30/70	28.3(195)	28.0(193)	1.1
	20/80	27.7(191)	27.5(189)	0.7
	10/90	27.1(187)	26.9(185)	0.7
	1/99	26.5(182)	26.5(182)	0.0
236faE/HFC-281fa				
	9.3/90.7	37.7(260)	37.7(260)	0.0
	1/99	37.7(260)	37.7(260)	0.0
	20/80	37.7(260)	37.7(260)	0.0
	40/60	37.4(258)	37.4(258)	0.0
	60/40	36.6(252)	36.4(251)	0.5
	70/30	35.9(247)	35.6(245)	0.8
	80/20	34.8(240)	34.2(236)	1.7
	90/10	32.9(227)	32.3(222)	1.8
	99/1	30.0(207)	29.9(206)	0.3
245faEβγ/HFC-356mff				
	1.0/99.0	14.9 (103)	14.9 (103)	0.0
	4.4/95.6	14.9 (103)	14.9 (103)	0.0

	10.0/90.0	14.9 (103)	14.9 (103)	0.0
	20.0/80.0	14.8 (102)	14.8 (102)	0.0
	30.0/70.0	14.7 (101)	14.7 (101)	0.0
	40.0/60.0	14.6 (100)	14.6 (100)	0.0
	50.0/50.0	14.4 (99)	14.3 (99)	0.7
	60.0/40.0	14.2 (98)	14.1 (97)	0.7
	70.0/30.0	13.9 (96)	13.8 (95)	0.7
	80.0/20.0	13.6 (93)	13.4 (93)	1.5
	90.0/10.0	13.2 (91)	13.1 (90)	0.8
	99.0/1.0	12.8 (88)	12.7 (88)	0.8

EXAMPLE 3

Refrigerant Performance

The following table shows the refrigerant performance of various compositions. Except where indicated, the data are based on the following conditions.

Evaporator temperature	45.0°F (7.2°C)
Condenser temperature	130.0°F (54.4°C)
Subcool temperature	15°F
Return gas temperature	65.0°F (18.3°C)

Compressor efficiency is 75%.

TABLE 4

Refrig. Comp.	Evap. Press. Psia (kPa)	Cond. Press. Psia (kPa)	Comp. Dis. Temp. °F (°C)	COP	Capacity BTU/min (kw)
HCFC-22	90.6 (625)	312.6 (2155)	212.8 (100.4)	3.41	351.3 (6.2)
125E/HFC-32					
5.0/95.0	146.3 (1009)	502.6 (3465)	250.5 (121.0)	3.14	544.0 (9.6)
40.0/60.0	134.4 (927)	462.2 (3187)	217.3 (102.9)	3.11	474.9 (8.3)
95.0/5.0	82.4 (568)	298.2 (2056)	162.0 (72.2)	3.04	272.7 (4.8)
125E/HFC-125					
5.0/95.0	16.2 (112)	70.8 (488)	166.3 (74.6)	3.99	85.8 (1.5)
95.0/5.0*	49.8 (343)	236.8 (1633)	120.5 (49.2)	3.14	209.6 (3.7)

* = Condenser temp. is 80°F, evaporator temp. is 0°F, subcool temp. is 25°F and return gas is 20°F

125E/HFC-134					
99.0/1.0	74.1 (511)	271.9 (1875)	156.4 (69.1)	2.98	241.6 (4.2)
86.5/13.5	72.3 (498)	266.2 (1835)	158.1 (70.1)	3.06	244.5 (4.3)
37.0/63.0	56.2 (387)	218.2 (1504)	166.9 (74.9)	3.43	228.4 (4.0)
5.0/95.0	44.5 (307)	179.4 (1237)	173.1 (78.4)	3.58	197.6 (3.5)
125E/HFC-134a					
5.0/95.0	56.1 (387)	215.9 (1489)	172.0 (77.8)	3.44	228.7 (4.0)
50.0/50.0	63.6 (439)	240.2 (1655)	164.5 (73.6)	3.27	238.6 (4.2)
95.0/5.0	73.0 (503)	268.9 (1854)	157.2 (69.6)	3.00	241.2 (4.2)
125E/HFC-143					
5.0/95.0	17.7 (122)	77.8 (536)	190.0 (87.8)	3.87	93.0 (1.6)
92.0/8.0	64.7 (446)	248.4 (1713)	165.0 (73.9)	3.12	231.3 (4.1)
99.0/1.0	76.3 (526)	280.3 (1933)	160.3 (71.3)	3.05	254.9 (4.5)
125E/HFC-143a					
5.0/95.0*	110.8 (764)	367.1 (2531)	216.7 (102.6)	3.18	384.5 (6.8)
95.0/5.0+	33.1 (228)	143.5 (989)	119.4 (48.6)	3.40	145.9 (2.6)

* = Subcool temp. is 20°F

+ = Condenser temp. is 80°F, evaporator temp. is 0°F and return gas temp. is 20°F

125E/HFC-152a					
5.0/95.0	52.1 (359)	197.2 (1360)	202.1 (94.5)	3.60	227.5 (4.0)
84.4/15.6	75.4 (520)	274.4 (1892)	168.7 (75.9)	3.17	264.0 (4.6)
95.0/ 5.0	77.6 (535)	282.9 (1951)	163.9 (73.3)	3.07	260.2 (4.6)
125E/HFC-161					
5.0/95.0	80.4 (554)	282.6 (1948)	200.3 (93.5)	3.47	317.4 (5.6)
66.5/35.5	89.6 (618)	311.9 (2150)	178.9 (81.6)	3.23	314.7 (5.5)
99.0/ 1.0	78.9 (544)	288.0 (1986)	162.4 (72.4)	3.02	259.3 (4.6)
125E/HFC-227ca					
5.0/95.0	38.2 (263)	149.4 (1030)	143.7 (62.1)	3.22	141.4 (2.5)
95.0/5.0	75.4 (520)	277.1 (1911)	160.9 (71.6)	3.04	250.5 (4.4)
125E/HFC-227ea					
5.0/95.0	30.4 (210)	130.4 (899)	140.9 (60.5)	3.24	121.2 (2.1)
95.0/5.0	74.6 (514)	276.0 (1903)	161.0 (71.7)	3.04	249.2 (4.4)
125E/HFC-236cb					
5.0/95.0	20.0 (138)	86.2 (594)	146.1 (63.4)	3.57	90.8 (1.6)
95.0/5.0	71.1 (490)	267.4 (1844)	161.7 (72.1)	3.08	244.8 (4.3)

125E/HFC-236fa					
5.0/95.0	21.9 (151)	93.2 (643)	145.9 (63.3)	3.53	97.1 (1.7)
95.0/5.0	71.8 (495)	268.8 (1853)	161.5 (71.9)	3.08	245.9 (4.3)
125E/HFC-245ca					
5.0/95.0	8.46 (58)	42.6 (294)	156.8 (69.3)	3.97	48.7 (0.9)
95.0/5.0	61.2 (422)	250.5 (1727)	165.9 (74.4)	3.08	226.2 (4.0)
125E/HFC-245cb					
5.0/95.0	37.9 (261)	143.0 (986)	139.7 (59.8)	3.33	143.0 (2.5)
95.0/5.0	74.2 (512)	276.8 (1908)	161.5 (71.9)	3.00	246.0 (4.3)
125E/HFC-245ea					
5.0/95.0	8.41 (58)	43.2 (298)	161.4 (71.9)	4.00	49.6 (0.9)
95.0/5.0	61.2 (422)	251.0 (1731)	166.2 (74.6)	3.08	226.6 (4.0)
125E/HFC-245fa					
5.0/95.0	12.7 ((88)	59.7 (412)	154.4 (68.0)	3.80	66.4 (1.2)
95.0/5.0	61.9 (427)	258.4 (1782)	167.6 (75.3)	2.88	216.9 (3.8)
125E/HFC-254ca					
5.0/95.0	8.05 (56)	40.5 (279)	160.0 (71.1)	3.99	46.8 (0.8)
95.0/5.0	59.0 (407)	245.6 (1693)	166.7 (74.8)	3.09	222.0 (3.9)
125E/HFC-254cb					
5.0/95.0	20.0 (138)	85.0 (586)	154.6 (68.1)	3.67	93.8 (1.6)
95.0/5.0	69.7 (481)	263.2 (1815)	162.1 (72.3)	3.11	243.4 (4.3)
125E/HFC-254eb					
5.0/95.0	69.3 (478)	263.5 (1817)	162.5 (72.5)	3.08	241.1 (4.2)
95.0/5.0	67.1 (463)	270.3 (1864)	166.6 (74.8)	2.87	226.9 (4.0)
125E/HFC-263ca					
5.0/95.0	10.6 (73)	49.5 (341)	161.5 (71.9)	3.90	57.3 (1.0)
95.0/5.0	61.4 (423)	246.6 (1700)	164.9 (73.8)	3.14	228.5 (4.0)
125E/HFC-263fb					
5.0/95.0	31.7 (219)	124.2 (856)	155.0 (68.3)	3.54	134.2 (2.4)
95.0/5.0	72.6 (501)	268.6 (1852)	161.3 (71.8)	3.10	248.1 (4.4)
125E/HFC-272ca					
5.0/95.0	20.1 (139)	82.4 (568)	160.4 (71.3)	3.74	94.7 (1.7)
95.0/5.0	67.4 (465)	255.6 (1762)	162.3 (72.4)	3.16	240.8 (4.2)
125E/HFC-272ea					
5.0/95.0	11.8 (81)	54.9 (379)	170.0 (76.7)	3.90	64.1 (1.1)

	95.0/5.0	61.1 (421)	244.5 (1686)	165.1 (73.9)	3.17	229.2 (4.0)
	125E/HFC-272fb					
	5.0/95.0	15.0 (103)	67.4 (465)	168.1 (75.6)	3.83	78.0 (1.4)
	95.0/5.0	64.3 (443)	250.4 (1726)	163.8 (73.2)	3.17	235.5 (4.1)
	125E/HFC-281ea					
	5.0/95.0	27.4 (189)	107.9 (744)	167.8 (75.4)	3.71	124.5 (2.2)
	95.0/5.0	69.1 (476)	258.2 (1780)	162.3 (72.4)	3.16	244.6 (4.3)
	125E/HFC-281fa					
	5.0/95.0	21.5 (148)	89.8 (619)	169.0 (76.1)	3.75	103.6 (1.8)
	95.0/5.0	66.4 (458)	252.4 (1740)	162.9 (72.7)	3.19	240.1 (4.2)
	134E/HFC-227ea					
	5.0/95.0	35.9 (248)	141.5 (976)	143.9 (62.2)	3.23	134.7 (2.4)
	7.3/92.7	36.0 (248)	141.7 (977)	144.5 (62.5)	3.24	135.5 (2.4)
	95.0/5.0	16.7 (115)	79.1 (545)	173.0 (78.3)	3.82	89.3 (1.6)
	134E/HFC-236fa					
	14.2/85.8	21.2 (146)	91.1 (628)	148.6 (64.8)	3.50	94.3 (1.7)
	5.0/95.0	20.6 (142)	88.6 (611)	146.3 (63.5)	3.48	91.1 (1.6)
	95.0/5.0	15.7 (108)	75.9 (523)	174.0 (78.9)	3.74	83.5 (1.5)
	134E/HFC-254eb					
	28.6/71.4	19.0 (131)	82.9 (572)	159.2 (70.7)	3.64	90.4 (1.6)
	5.0/95.0	19.0 (131)	81.6 (563)	155.2 (68.4)	3.62	88.7 (1.6)
	95.0/5.0	15.5 (107)	74.9 (516)	174.5 (79.2)	3.73	82.2 (1.4)
	134E/HFC-356mff					
	97.1/2.9	15.1 (104)	73.5 (507)	174.4 (79.1)	3.73	80.6 (1.4)
	5.0/95.0	8.0 (55)	41.6 (287)	139.4 (59.7)	3.60	41.8 (0.7)
	95.0/5.0	15.1 (104)	73.4 (506)	173.4 (78.6)	3.72	80.4 (1.4)
	134aE/HFC-32					
	5.0/95.0	148.4 (1023)	506.8 (3494)	199.1 (92.8)	3.15	511.8 (9.0)
	95.0/5.0	51.1 (352)	201.2 (1387)	167.8 (75.4)	3.56	216.6 (3.8)
	55/45*	55.4(382)	227.7(1571)	153.7(67.6)	3.50	247.5(4.4)
	11.5/88.5*	77.6(535)	293.8(2027)	163.5(73.1)	3.48	328.8(5.8)
	1/99*	78.9(544)	299.8(2068)	166.8(74.9)	3.49	337.2(5.9)

* Condenser temp. 90°F, evaporator temp. 10°F, and return gas temp. 30°F

134aE/HFC-125					
5.0/95.0	113.6 (783)	382.2 (2635)	170.1 (76.7)	2.80	325.1 (5.7)
95.0/5.0	44.6 (308)	178.2 (1229)	164.7 (73.7)	3.45	185.2 (3.3)

134aE/HFC-134						
99.0/1.0	41.8 (288)	167.7 (1156)	164.1 (73.4)	3.45	174.7 (3.1)
42.6/57.4	42.9 (296)	171.5 (1183)	174.1 (78.9)	3.53	185.8 (3.3)
1.0/99.0	42.2 (291)	169.6 (1169)	182.2 (83.4)	3.59	188.7 (3.3)
134aE/HFC-134a					
5.0/95.0	53.9 (372)	212.0 (1462)	170.8 (77.1)	3.42	221.2 (3.9)
95.0/5.0	42.4 (292)	170.1 (1173)	164.5 (73.6)	3.44	176.8 (3.1)
134aE/HFC-143					
5.0/95.0	16.7 (115)	74.9 (516)	192.5 (89.2)	3.81	87.9 (1.5)
95.0/5.0	38.9 (268)	158.7 (1094)	166.0 (74.4)	3.48	166.8 (2.9)
134aE/HFC-143a					
5.0/95.0	108.7 (749)	361.3 (2491)	216.8 (102.7)	3.20	381.9 (6.7)
95.0/5.0	45.2 (312)	179.7 (1239)	166.9 (74.9)	3.46	188.3 (3.3)
134aE/HFC-152					
99/1	41.9(289)	168.2(1160)	164.5(73.6)	3.45	175.3(3.1)
19.1/80.9	50.0(345)	191.4(1160)	197.6(73.6)	3.59	218.2(3.1)
1/99	50.8(350)	193.2(1320)	203.8(92.0)	3.61	223.3(2.8)
134aE/HFC-152a					
5.0/95.0	50.6 (349)	192.8 (1329)	202.5 (94.7)	3.60	222.3 (3.9)
95.0/5.0	42.7 (294)	170.5 (1176)	166.4 (74.7)	3.46	178.8 (3.1)
99/1	41.9 (289)	168.2 (1161)	164.5 (73.6)	3.45	175.3 (3.1)
19.1/80.9	50.0 (345)	191.4 (1161)	197.6 (73.6)	3.59	218.2 (3.1)
1/99	50.8 (351)	193.2 (1321)	203.8 (92.0)	3.61	223.3 (2.8)
134aE/HFC-161					
5.0/95.0	79.0 (545)	277.8 (1915)	200.1 (93.4)	3.49	313.7 (5.5)
95.0/5.0	45.5 (314)	180.6 (1245)	167.6 (75.3)	3.45	189.2 (3.3)
134aE/HFC-227ca					
5.0/95.0	37.8 (261)	148.1 (1021)	143.9 (62.2)	3.21	140.0 (2.5)
95.0/5.0	42.4 (292)	169.5 (1169)	163.1 (72.8)	3.42	175.0 (3.1)
99/1	41.9(289)	167.9(1158)	163.8(73.2)	3.44	174.5(3.1)
65.5/34.5	44.7(308)	174.0(1200)	156.6(69.2)	3.33	173.9(3.1)
1/99	36.8(253)	143.8(992)	142.8(61.6)	3.21	136.1(2.4)
134aE/HFC-227ea					
5.0/95.0	36.9 (254)	145.3 (1002)	143.9 (62.2)	3.22	137.7 (2.4)
95.0/5.0	42.2 (291)	169.3 (1167)	163.1 (72.8)	3.42	174.5 (3.1)
99/1	41.7 (288)	167.5 (1156)	163.7 (73.2)	3.45	174.2 (3.1)
65.4/34.6	39.7 (274)	160.8 (1110)	156.0 (68.9)	3.37	161.3 (2.8)
1/99	28.6 (198)	123.6 (853)	139.8 (59.9)	3.22	114.2 (2.0)

134aE/HFC-236ca					
5.0/95.0	14.2 (98)	66.5 (459)	152.1 (66.7)	3.65	70.6 (1.2)
95.0/5.0	39.7 (274)	161.4 (1113)	163.9 (73.3)	3.45	167.8 (3.0)
134aE/HFC-236cb					
5.0/95.0	19.5 (134)	84.6 (583)	146.6 (63.7)	3.52	87.9 (1.5)
95.0/5.0	40.7 (281)	164.0 (1131)	163.2 (72.9)	3.45	170.5 (3.0)
134aE/HFC-236fa					
5.0/95.0	21.4 (148)	91.6 (632)	146.3 (63.5)	3.49	94.4 (1.7)
95.0/5.0	41.0 (283)	165.1 (1138)	163.3 (72.9)	3.43	170.8 (3.0)
134aE/HFC-245ca					
5.0/95.0	7.9 (54)	40.9 (282)	158.2 (70.1)	3.84	45.0 (0.8)
95.0/5.0	36.8 (254)	154.9 (1068)	165.7 (74.3)	3.45	159.8 (2.8)
134aE/HFC-245cb					
5.0/95.0	36.6 (252)	139.3 (960)	140.1 (60.1)	3.31	138.5 (2.4)
95.0/5.0	41.7 (288)	166.7 (1149)	162.6 (72.6)	3.44	173.1 (3.0)
99/1	41.8 (288)	167.4 (1155)	163.7 (73.2)	3.45	174.2 (3.1)
57.7/42.3	40.4 (279)	157.8 (1089)	152.7 (67.1)	3.39	161.0 (2.8)
1/99	36.3 (251)	137.6 (949)	139.2 (59.6)	3.31	136.6 (2.4)
134aE/HFC-245ea					
5.0/95.0	7.9 (54)	41.5 (286)	163.0 (72.8)	3.86	45.6 (0.8)
95.0/5.0	36.7 (253)	155.2 (1070)	166.1 (74.5)	3.44	159.4 (2.8)
134aE/HFC-245fa					
5.0/95.0	12.1 (83)	57.8 (399)	155.4 (68.6)	3.71	62.4 (1.1)
95.0/5.0	38.7 (267)	158.9 (1096)	164.3 (73.5)	3.46	165.4 (2.9)
134aE/HFC-254ca					
5.0/95.0	7.6 (52)	39.0 (269)	161.4 (71.8)	3.86	43.2 (0.8)
95.0/5.0	35.9 (248)	152.6 (1052)	166.3 (74.6)	3.45	157.1 (2.8)
134aE/HFC-254cb					
5.0/95.0	19.4 (134)	83.1 (573)	155.0 (68.3)	3.63	90.6 (1.6)
95.0/5.0	39.9 (275)	161.5 (1114)	163.8 (73.2)	3.46	168.3 (3.0)
134aE/HFC-254eb					
5.0/95.0	19.7 (136)	84.3 (581)	154.9 (68.3)	3.63	91.9 (1.6)
95.0/5.0	39.9 (275)	161.6 (1114)	163.7 (73.2)	3.46	168.6 (3.0)
134aE/HFC-263ca					
5.0/95.0	10.1 (70)	48.0 (331)	162.5 (72.5)	3.81	54.1 (1.0)
95.0/5.0	36.8 (254)	153.7 (1060)	165.4 (74.1)	3.47	160.0 (2.8)

134aE/HFC-263fb					
5.0/95.0	31.0 (214)	121.9 (840)	155.2 (68.4)	3.53	131.3 (2.3)
95.0/5.0	41.0 (283)	164.5 (1134)	163.4 (73.0)	3.45	171.7 (3.0)
134aE/HFC-272ca					
5.0/95.0	19.6 (135)	80.7 (556)	160.8 (71.6)	3.71	91.9 (1.6)
95.0/5.0	39.1 (270)	158.4 (1092)	164.0 (73.3)	3.48	166.7 (2.9)
134aE/HFC-272ea					
5.0/95.0	11.3 (78)	53.6 (370)	171.0 (77.2)	3.82	61.1 (1.1)
95.0/5.0	36.7 (253)	153.2 (1056)	165.8 (74.3)	3.48	160.0 (2.8)
134aE/HFC-272fb					
5.0/95.0	14.6 (101)	66.0 (455)	168.8 (76.0)	3.77	75.0 (1.3)
95.0/5.0	38.0 (262)	155.9 (1075)	165.0 (73.9)	3.49	163.7 (2.9)
134aE/HFC-281ea					
5.0/95.0	26.9 (185)	106.3 (733)	168.0 (75.6)	3.69	122.1 (2.1)
95.0/5.0	39.9 (275)	160.4 (1106)	164.3 (73.5)	3.49	169.2 (3.0)
134aE/HFC-281fa					
5.0/95.0	21.1 (145)	88.4 (610)	169.5 (76.4)	3.72	101.0 (1.8)
95.0/5.0	38.9 (268)	157.8 (1088)	164.7 (73.7)	3.49	166.1 (2.9)
143aE/HFC-32					
5.0/95.0	147.8 (1019)	504.7 (3480)	199.1 (92.8)	3.16	510.9 (9.0)
95.0/5.0	55.7 (384)	211.3 (1457)	170.0 (76.7)	3.55	230.2 (4.1)
54/46	106.8(736)	385.7(2661)	188.3(86.8)	3.25	391.0(6.9)
6.2/93.8	147.5(1017)	502.7(3468)	198.5(92.5)	3.17	509.9(9.0)
1/99	149.2(1029)	509.7(3516)	200.0(93.3)	3.16	518.0(9.1)
143aE/HFC-125					
5.0/95.0	115.3 (795)	385.6 (2659)	170.2 (76.8)	2.80	328.3 (5.8)
95.0/5.0	50.6 (349)	193.4 (1333)	167.5 (75.3)	3.47	205.8 (3.6)
143aE/HFC-134					
99.0/1.0	47.9 (33)	183.8 (1267)	167.2 (75.1)	3.48	196.1 (3.4)
92.4/7.6	47.6 (328)	183.3 (1264)	168.1 (75.6)	3.48	196.1 (3.4)
1.0/99.0	42.2 (291)	169.8 (1171)	182.2 (83.4)	3.59	188.9 (3.3)
143aE/HFC-134a					
5.0/95.0	54.1 (373)	212.3 (1464)	170.8 (77.1)	3.43	222.0 (3.9)
95.0/5.0	48.2 (332)	185.2 (1277)	167.2 (75.1)	3.47	197.2 (3.5)

143aE/HFC-143						
	5.0/95.0	16.9 (117)	75.7 (522)	192.3 (89.1)	3.83	89.1 (1.6)
	95.0/5.0	44.4 (306)	174.1 (1200)	168.9 (76.1)	3.50	186.8 (3.3)
143aE/HFC-143a						
	5.0/95.0	108.8 (750)	361.8 (2495)	216.8 (102.7)	3.20	380.8 (6.7)
	95.0/5.0	50.5 (348)	194.6 (1342)	170.2 (76.8)	3.44	205.2 (3.6)
	53/47	77.4(534)	275.0(1897)	189.0(87.2)	3.37	292.4(5.1)
	8.7/91.3*	106.8(736)	355.5(2453)	214.0(101.1)	3.23	376.8(6.6)
	1/99*	111.7(770)	368.5(2542)	219.1(103.9)	3.19	388.4(6.8)
143aE/HFC-152a						
	5.0/95.0	50.6 (349)	192.7 (1329)	202.5 (94.7)	3.60	222.4 (3.9)
	95.0/5.0	48.0 (331)	184.2 (1270)	169.1 (76.2)	3.49	197.7 (3.5)
	99/1	47.9(330)	183.9(1268)	167.5(75.3)	3.47	196.4(3.5)
	48.6/51.4	49.2(339)	188.3(1299)	186.9(86.1)	3.57	211.2(3.7)
	1/99	50.8(350)	193.2(1333)	203.8(95.4)	3.61	223.3(3.9)
143aE/HFC-161						
	5.0/95.0	78.9 (544)	277.6 (1914)	200.3 (93.5)	3.48	313.1 (5.5)
	95.0/5.0	50.7 (350)	193.7 (1336)	170.0 (76.7)	3.47	206.7 (3.6)
143aE/HFC-227ca						
	5.0/95.0	38.6 (266)	150.9 (1040)	144.4 (62.4)	3.22	143.0 (2.5)
	95.0/5.0	48.5 (334)	186.0 (1282)	166.1 (74.5)	3.45	196.5 (3.5)
	99/1	48.0(331)	184.3(1271)	166.9(74.9)	3.47	196.1(3.5)
	71.5/28.5	50.6(349)	190.7(1315)	160.5(71.4)	3.37	195.4(3.4)
	1/99	36.9(254)	144.6(997)	142.9(161)	3.21	136.7(2.4)
143aE/HFC-227ea						
	5.0/95.0	37.8 (261)	148.3 (1022)	144.4 (62.4)	3.23	141.0 (2.5)
	95.0/5.0	48.5 (334)	185.9 (1282)	166.1 (74.5)	3.45	196.5 (3.5)
	99/1	48.0(331)	184.3(1271)	166.9(74.9)	3.47	196.1(3.5)
	75.6/24.4	50.5(348)	190.4(1313)	161.4(71.9)	3.39	196.3(3.5)
	1/99	36.9(254)	144.6(997)	142.6(61.4)	3.21	136.7(2.4)
143aE/HFC-236ca						
	5.0/95.0	14.6 (101)	68.4 (472)	152.3 (66.8)	3.67	73.2 (1.3)
	95.0/5.0	45.7 (315)	178.3 (1229)	167.1 (75.1)	3.47	188.9 (3.3)
143aE/HFC-236cb						
	5.0/95.0	19.9 (137)	86.2 (594)	146.9 (63.8)	3.54	90.2 (1.6)
	95.0/5.0	46.7 (322)	180.6 (1245)	166.5 (74.7)	3.46	191.2 (3.4)
143aE/HFC-236fa						

*subcool temp. 20°F

	5.0/95.0	22.0 (152)	93.7 (646)	146.6 (63.7)	3.51	97.2 (1.7)
	95.0/5.0	47.1 (325)	181.6 (1252)	166.3 (74.6)	3.46	192.4 (3.4)
	143aE/HFC-245ca					
	5.0/95.0	8.3 (57)	42.3 (292)	158.4 (70.2)	3.88	47.0 (0.8)
	95.0/5.0	42.6 (294)	171.3 (1181)	168.8 (76.0)	3.46	180.3 (3.2)
	143aE/HFC-245cb					
	5.0/95.0	37.2 (256)	140.9 (971)	140.3 (60.2)	3.32	140.7 (2.5)
	95.0/5.0	47.7 (329)	182.8 (1260)	165.7 (74.3)	3.47	194.2 (3.4)
	99/1	48.0(331)	184.3(1271)	166.9(73.3)	3.47	196.1(3.5)
	59.6/40.4	50.9(351)	190.6(1315)	157.7(69.8)	3.33	192.1(3.4)
	20/80	44.3(305)	169.4(1168)	148.5(64.7)	3.25	163.3(2.9)
	143aE/HFC-245ea					
	5.0/95.0	8.2 (57)	42.7 (294)	163.0 (72.8)	3.90	47.7 (0.8)
	95.0/5.0	42.3 (292)	171.3 (1181)	169.5 (76.4)	3.45	179.6 (3.2)
	143aE/HFC-245fa					
	5.0/95.0	12.5 (86)	59.4 (410)	155.0 (68.3)	3.74	65.0 (1.1)
	95.0/5.0	44.6 (308)	175.4 (1209)	167.5 (75.3)	3.48	186.2 (3.3)
	143aE/HFC-254ca					
	5.0/95.0	7.8 (54)	40.1 (276)	161.5 (71.9)	3.90	45.1 (0.8)
	95.0/5.0	41.5 (286)	168.9 (1165)	169.6 (76.4)	3.45	177.1 (3.1)
	143aE/HFC-254cb					
	5.0/95.0	19.7 (136)	84.3 (581)	155.3 (68.5)	3.64	92.3 (1.6)
	95.0/5.0	45.9 (316)	177.8 (1226)	166.8 (74.9)	3.48	189.6 (3.3)
	143aE/HFC-254eb					
	5.0/95.0	20.1 (139)	85.6 (590)	155.2 (68.4)	3.63	93.6 (1.6)
	95.0/5.0	45.9 (31.6)	177.9 (1227)	166.7 (74.8)	3.48	189.9 (3.3)
	143aE/HFC-263ca					
	5.0/95.0	10.3 (71)	48.9 (337)	162.6 (72.6)	3.83	55.6 (1.0)
	95.0/5.0	42.4 (292)	169.7 (1170)	168.7 (75.9)	3.48	179.9 (3.2)
	143aE/HFC-263fb					
	5.0/95.0	31.3 (216)	122.9 (847)	155.4 (68.6)	3.53	132.5 (2.3)
	95.0/5.0	46.9 (323)	180.3 (1243)	166.4 (74.7)	3.48	192.4 (3.4)
	143aE/HFC-272ca					
	5.0/95.0	19.9 (137)	81.6 (563)	160.9 (71.6)	3.71	93.1 (1.6)
	95.0/5.0	44.9 (310)	174.3 (1202)	167.0 (75.0)	3.50	187.2 (3.3)
	143aE/HFC-272ea					

	5.0/95.0	11.5 (79)	54.3 (374)	171.0 (77.2)	3.84	62.3 (1.1)
	95.0/5.0	42.2 (291)	168.9 (1165)	169.0 (76.1)	3.49	179.8 (3.2)
	143aE/HFC-272fb					
	5.0/95.0	14.8 (102)	66.7 (460)	168.9 (76.1)	3.78	76.1 (1.3)
	95.0/5.0	43.5 (300)	171.7 (1184)	168.1 (75.6)	3.50	183.7 (3.2)
	143aE/HFC-281ea					
	5.0/95.0	27.0 (186)	106.7 (736)	168.2 (75.7)	3.69	122.5 (2.2)
	95.0/5.0	45.3 (312)	175.2 (1208)	167.3 (75.2)	3.51	188.6 (3.3)
	143aE/HFC-281fa					
	5.0/95.0	21.3 (147)	89.0 (614)	169.5 (76.4)	3.73	101.9 (1.8)
	95.0/5.0	44.4 (306)	173.1 (1193)	167.6 (75.3)	3.51	186.0 (3.3)
	C216E/HFC-32					
	5.0/95.0*	156.5 (1079)	525.3 (3622)	197.4 (91.9)	3.30	556.2 (9.8)
	95.0/5.0	76.7 (529)	238.9 (1647)	150.5 (65.8)	3.15	252.8 (4.4)

* = subcool temperature of 20.0°F

C216E/HFC-125					
5.0/95.0*	62.6 (432)	230.8 (1591)	131.3 (55.2)	3.28	233.2 (4.1)
95.0/5.0	58.8 (405)	210.4 (1451)	141.0 (60.0)	2.95	182.0 (3.2)

* = evaporator temperature of 10.0°F, condenser temperature of 90.0°F and return gas of 30.0°F

C216E/HFC-134					
99.0/1.0	60.2 (415)	217.4 (1499)	140.3 (61.2)	2.96	190.1 (3.3)
79.8/20.2	69.3 (478)	245.1 (1690)	146.3 (63.5)	3.01	219.9 (3.9)
1.0/99.0	43.1 (297)	174.9 (1206)	173.9 (78.8)	3.58	192.8 (3.4)
C216E/HFC-134a					
5.0/95.0	56.9 (392)	221.2 (1525)	169.4 (76.3)	3.41	229.8 (4.0)
95.0/5.0	59.5 (410)	212.8 (1467)	141.2 (60.7)	2.96	184.1 (3.2)
99/1	58.8(405)	196.4(1355)	135.6(57.6)	3.24	189.3(3.3)
61.7/38.3	56.2(387)	202.3(1395)	139.6(39.8)	2.93	173.3(3.1)
1/99	55.1(380)	215.3(1485)	170.5(76.9)	3.44	225.4(4.0)
C216E/HFC-143					
5.0/95.0	18.2 (125)	78.9 (544)	188.7 (87.1)	3.97	97.1 (1.7)
95.0/5.0	54.8 (378)	196.7 (1356)	141.2 (60.7)	3.01	174.1 (3.1)
C216E/HFC-143a					
5.0/95.0*	110.9 (765)	365.8 (2522)	215.2 (101.8)	3.18	383.3 (6.7)

	95.0/5.0	60.0 (414)	214.1 (1476)	143.2 (61.8)	2.99	188.0 (3.3)

* = subcool temperature of 20.0°F

C216E/HFC-152a					
5.0/95.0	52.8 (364)	199.0 (1372)	201.0 (93.9)	3.61	230.2 (4.0)
95.0/5.0	61.2 (422)	217.9 (1502)	143.5 (61.9)	2.98	190.9 (3.4)
99/1	57.0(383)	203.5(1404)	193.0(59.4)	2.96	176.5(3.1)
77.6/22.4	72.4(499)	250.0(1725)	155.0(68.3)	3.08	231.5(4.1)
1/99	51.0(351)	195.0(1345)	204.3(95.7)	3.58	223.6(3.9)
C216E/HFC-161					
5.0/95.0	81.6 (563)	284.8 (1964)	199.1 (92.8)	3.49	321.2 (5.6)
95.0/5.0	66.8 (461)	237.7 (1639)	145.9 (63.3)	3.00	209.6 (3.7)
99/1	58.4(403)	207.9(1434)	140.2(60.1)	2.99	182.2(3.2)
58.8/41.2	98.5(679)	325.5(2246)	171.2(77.3)	3.13	315.7(5.6)
1/99	80.2(553)	280.6(1936)	200.8(93.8)	3.50	318.0(5.6)
C216E/HFC-227ca					
5.0/95.0	37.2 (256)	145.5 (1003)	142.5 (61.4)	3.19	136.5 (2.4)
95.0/5.0	54.3 (374)	196.0 (1351)	139.2 (59.6)	2.95	169.6 (3.0)
C216E/HFC-227ea					
5.0/95.0	36.3 (250)	142.5 (983)	142.5 (61.4)	3.20	134.2 (2.4)
95.0/5.0	54.1 (373)	195.6 (1349)	139.3 (59.6)	2.95	169.1 (3.0)
C216E/HFC-236ca					
5.0/95.0	14.4 (99)	66.8 (461)	150.3 (65.7)	3.68	71.6 (1.3)
95.0/5.0	51.3 (354)	189.2 (1304)	140.0 (60.0)	2.99	165.6 (2.9)
C216E/HFC-236cb					
5.0/95.0	19.4 (138)	84.3 (581)	145.2 (62.9)	3.52	87.3 (1.5)
95.0/5.0	52.4 (361)	191.2 (1318)	139.5 (59.7)	2.98	167.0 (2.9)
C216E/HFC-236fa					
5.0/95.0	21.3 (147)	90.9 (627)	144.8 (62.7)	3.48	93.5 (1.6)
95.0/5.0	52.5 (362)	191.7 (1322)	139.6 (59.8)	2.98	167.0 (2.9)
C216E/HFC-245ca					
5.0/95.0	8.4 (58)	42.2 (291)	156.5 (69.2)	3.96	48.1 (0.8)
95.0/5.0	48.0 (331)	183.5 (1265)	141.5 (60.8)	2.99	159.9 (2.8)
C216E/HFC-245cb					
5.0/95.0	37.1 (256)	140.4 (968)	139.0 (59.4)	3.29	138.6 (2.4)
95.0/5.0	54.8 (378)	196.9 (1358)	139.0 (59.4)	2.95	170.5 (3.0)
99/1	55.5(382)	198.8(1371)	139.0(59.4)	2.94	171.4(3.0)
95.1/4.9	54.8(378)	197.0(1359)	139.0(59.4)	2.95	170.6(3.0)

1/99	36.3(253)	138(952)	139.0(59.4)	3.30	136.4(2.4)
C216E/HFC-245ea					
5.0/95.0	8.6 (59)	43.5 (300)	159.4 (70.8)	4.06	50.9 (0.9)
95.0/5.0	49.2 (339)	185.9 (1282)	141.2 (60.7)	2.99	162.2 (2.9)
C216E/HFC-245fa					
5.0/95.0	12.5 (86)	58.9 (406)	153.4 (67.4)	3.78	65.1 (1.1)
95.0/5.0	50.6 (349)	187.8 (1295)	140.3 (60.2)	3.00	164.8 (2.9)
C216E/HFC-254ca					
5.0/95.0	8.2 (57)	40.7 (281)	158.3 (70.2)	4.04	47.8 (0.8)
95.0/5.0	47.7 (329)	182.5 (1258)	141.6 (60.9)	3.00	159.7 (2.8)
C216E/HFC-254cb					
5.0/95.0	19.7 (136)	84.0 (579)	153.7 (67.6)	3.65	92.0 (1.6)
95.0/5.0	52.4 (361)	190.9 (1316)	140.0 (60.0)	2.99	167.8 (2.9)
C216E/HFC-254eb					
5.0/95.0	20.1 (139)	85.3 (588)	153.7 (67.6)	3.64	93.2 (1.6)
95.0/5.0	52.5 (362)	191.1 (1318)	139.8 (59.9)	3.00	168.3 (3.0)
C216E/HFC-263ca					
5.0/95.0	10.7 (74)	49.6 (342)	160.1 (71.2)	3.93	58.1 (1.0)
95.0/5.0	49.1 (339)	183.8 (1267)	141.0 (60.6)	3.02	163.0 (2.9)
C216E/HFC-263fb					
5.0/95.0	31.5 (217)	123.4 (851)	154.3 (67.9)	3.52	132.5 (2.3)
95.0/5.0	54.4 (375)	195.5 (1348)	139.9 (59.9)	2.98	171.7 (3.0)
C216E/HFC-272ca					
5.0/95.0 (139)	20.1 (139)	82.2 (567)	159.6 (70.9)	3.74	94.4 (1.7)
95.0/5.0 (361)	52.4 (361)	189.9 (1309)	140.2 (60.1)	3.02	169.1 (3.0)
C216E/HFC-272ea					
5.0/95.0	12.3 (85)	56.1 (387)	167.8 (75.4)	4.00	67.6 (1.2)
95.0/5.0	51.2 (353)	187.8 (1295)	140.8 (60.4)	3.03	167.4 (2.9)
C216E/HFC-272fb					
5.0/95.0	15.5 (107)	68.4 (472)	166.5 (74.7)	3.89	80.6 (1.4)
95.0/5.0	52.6 (362)	190.9 (1316)	140.5 (60.3)	3.02	169.7 (3.0)
C216E/HFC-281ea					
5.0/95.0	27.6 (190)	108.3 (747)	167.0 (75.0)	3.72	125.2 (2.2)
95.0/5.0	55.2 (381)	197.1 (1359)	140.9 (60.5)	3.01	175.1 (3.1)

C216E/HFC-281fa					
5.0/95.0	21.9 (151)	90.5 (624)	168.0 (75.6)	3.78	105.3 (1.9)
95.0/5.0	54.2 (374)	194.5 (1341)	141.0 (60.6)	3.01	173.3 (3.1)
C-216E2/HFC-32					
5.0/95.0	149.0 (1027)	508.2 (3504)	198.2 (92.3)	3.16	513.2 (9.0)
36.0/64.0*	138.0 (951)	473.4 (3264)	184.7 (84.8)	3.21	475.3 (8.4)
95.0/5.0	56.1 (387)	216.3 (1491)	141.9 (61.1)	3.25	204.7 (3.6)
C-216E2/HFC-134					
5.0/95.0	42.7 (294)	171.6 (1183)	180.0 (82.2)	3.58	189.6 (3.3)
95.0/5.0	45.4 (313)	174.2 (1201)	136.2 (57.9)	3.11	159.2 (2.8)
60.5/39.5	48.5 (334)	186.1 (1283)	152.3 (66.8)	3.34	186.6 (3.3)
C-216E2/HFC-134a					
5.0/95.0	54.8 (378)	214.5 (1479)	169.2 (76.2)	3.42	222.9 (3.9)
20.7/79.4	55.5 (383)	214.9 (1482)	163.8 (73.2)	3.37	219.3 (3.9)
95.0/5.0	46.0 (317)	176.4 (1216)	135.9 (57.7)	3.11	160.9 (2.8)
C-216E2/HFC-143					
5.0/95.0	16.7 (115)	74.8 (516)	190.8 (88.2)	3.83	88.1 (1.6)
87.1/12.9	36.4 (251)	146.7 (1011)	142.3 (61.3)	3.30	143.2 (2.5)
95.0/5.0	41.0 (283)	160.5 (1107)	137.0 (58.3)	3.18	149.8 (2.6)
C-216E2/HFC-152a					
60.5/39.5	53.8 (371)	200.7 (1384)	164.6 (73.7)	3.42	210.7 (3.7)
5.0/95.0	51.1 (352)	194.3 (1340)	201.3 (94.1)	3.59	223.4 (3.9)
95.0/5.0	46.7 (322)	178.4 (1230)	138.2 (59.0)	3.15	165.3 (2.9)
C-216E2/HFC-161					
45.7/54.3	78.8 (543)	275.5 (1900)	178.6 (81.4)	3.39	294.1 (5.2)
5.0/95.0	79.9 (551)	279.8 (1929)	199.1 (92.8)	3.49	315.6 (5.6)
95.0/5.0	51.4 (354)	194.9 (1344)	140.4 (60.2)	3.17	182.1 (3.2)
C-216E2/HFC-245cb					
74.7/25.3	41.2 (284)	158.2 (1091)	135.3 (57.4)	3.16	147.4 (2.6)
5.0/95.0	36.4 (251)	138.4 (954)	138.8 (59.3)	3.29	136.7 (2.4)
95.0/5.0	43.5 (300)	167.2 (1153)	134.1 (56.7)	3.09	151.5 (2.7)
218E/HFC-32					
5.0/95.0*	155.2 (1070)	523.5 (3609)	197.5 (91.9)	3.30	553.7 (9.7)
95.0/5.0	69.2 (477)	279.5 (1927)	151.1 (66.2)	2.94	227.1 (4.0)

* = subcool temperature of 20.0°F

218E/HFC-125						
5.0/95.0	62.6 (432)	231.3 (1595)	131.4 (55.2)	3.28	233.0 (4.1)
95.0/5.0	52.1 (359)	203.0 (1400)	140.0 (60.0)	2.83	162.4 (2.9)
218E/HFC-134						
99.0/1.0	49.1 (339)	192.4 (1327)	138.2 (59.0)	2.80	152.6 (2.7)
63.3/36.7	63.7 (439)	235.1 (1621)	153.2 (67.3)	3.04	211.5 (3.7)
35.0/65.0	54.8 (378)	213.6 (1473)	167.0 (75.0)	3.34	215.8 (3.8)
5.0/95.0	44.6 (308)	177.3 (1222)	179.4 (81.9)	3.62	198.5 (3.5)
218E/HFC-134a						
5.0/95.0	56.5 (390)	220.5 (1520)	169.5 (76.4)	3.41	228.9 (4.0)
95.0/5.0	52.8 (364)	205.7 (1418)	140.4 (60.2)	2.82	164.4 (2.9)
99/1	49.3(340)	192.8(1330)	138.0(53.3)	2.81	153.4(2.7)
53.0/47.0	70.4(485)	258.8(1785)	154.2(67.9)	3.00	228.7(4.0)
1/99	55.0(379)	215.4(1486)	170.6(77.0)	3.43	225.2(4.0)
218E/HFC-143						
5.0/95.0	17.9 (123)	78.1 (538)	189.2 (87.3)	3.95	95.3 (1.7)
95.0/5.0	48.1 (332)	187.0 (1289)	139.8 (60.0)	2.90	155.0 (2.7)
218E/HFC-143a						
5.0/95.0*	110.8 (764)	366.5 (2527)	215.4 (101.9)	3.18	383.2 (6.7)
95.0/5.0	53.6 (370)	207.7 (1432)	142.5 (61.4)	2.86	169.4 (3.0)

* = subcool temperature of 20.0°F

218E/HFC-152a					
5.0/95.0	52.5 (362)	198.6 (1369)	201.1 (93.9)	3.61	229.5 (4.0)
95.0/5.0	54.8 (378)	211.7 (1460)	142.8 (61.6)	2.85	172.0 (3.0)
99/1	49.8(343)	194.4(1341)	138.6(59.2)	2.82	155.5(2.7)
68.2/31.8	69.8(481)	250.5(1728)	160.9(71.6)	3.12	234.9(4.1)
41/59	63.1(435)	232.3(1602)	179.3(81.8)	3.42	247.4(4.4)
218E/HFC-161					
5.0/95.0	81.5 (562)	284.7 (1963)	199.2 (92.9)	3.49	321.1 (5.7)
95.0/5.0*	61.1 (421)	236.0 (1627)	146.0 (63.3)	3.05	204.6 (3.6)
84/16*	88.3 (609)	275.7 (1907)	146.6 (63.7)	3.74	310.2 (5.5)
62.6/37.4	97.7(674)	329.2(2271)	169.3(76.3)	3.04	307.5(5.4)
39/61	92.2(636)	315.8(2179)	183.2(84.0)	3.30	329.2(5.8)

* = subcool temperature of 20.0°F

218E/HFC-227ca					
5.0/95.0	36.8 (254)	144.7 (998)	142.4 (61.3)	3.18	135.2 (2.4)
95.0/5.0	47.3 (326)	185.9 (1282)	137.8 (58.8)	2.82	148.1 (2.6)

218E/HFC-227ea					
5.0/95.0	35.0 (248)	141.8 (978)	142.4 (61.3)	3.20	133.2 (2.3)
95.0/5.0	47.3 (326)	185.7 (1280)	137.7 (58.7)	2.83	149.0 (2.6)
218E/HFC-236ca					
5.0/95.0	14.0 (97)	65.7 (453)	150.3 (65.7)	3.65	69.8 (1.2)
95.0/5.0	44.3 (305)	178.3 (1229)	138.3 (59.1)	2.88	145.4 (2.6)
218E/HFC-236cb					
5.0/95.0	19.1 (132)	83.0 (572)	145.0 (62.8)	3.51	85.7 (1.5)
95.0/5.0	45.1 (311)	179.8 (1240)	138.0 (58.9)	2.87	146.2 (2.6)
218E/HFC-236fa					
5.0/95.0	21.0 (145)	89.8 (619)	144.7 (626)	3.47	92.0 (1.6)
95.0/5.0	45.4 (313)	180.8 (1247)	138.0 (58.9)	2.86	146.6 (2.6)
218E/HFC-245ca					
5.0/95.0	8.1 (56)	41.2 (284)	156.0 (68.9)	3.91	56.8 (1.0)
95.0/5.0	41.2 (284)	172.2 (1187)	139.5 (59.7)	2.90	140.4 (2.5)
218E/HFC-245cb					
5.0/95.0	36.8 (254)	139.7 (963)	138.9 (59.3)	3.29	137.6 (2.4)
95.0/5.0	47.9 (330)	187.1 (1290)	137.5 (58.6)	2.83	150.4 (2.6)
218E/HFC-245ea					
5.0/95.0	8.2 (57)	42.5 (293)	160.1 (71.2)	3.99	48.5 (0.9)
95.0/5.0	42.3 (292)	174.7 (1205)	139.3 (59.6)	2.89	142.4 (2.5)
218E/HFC-245fa					
5.0/95.0	12.2 (84)	58.0 (400)	153.6 (67.6)	3.74	63.2 (1.1)
95.0/5.0	43.8 (302)	176.8 (1219)	138.5 (59.2)	2.90	145.0 (2.6)
218E/HFC-254ca					
5.0/95.0	7.9 (54)	39.8 (274)	159.0 (70.6)	3.97	45.6 (0.8)
95.0/5.0	40.9 (282)	171.0 (1179)	139.6 (59.8)	2.91	140.4 (2.5)
218E/HFC-254cb					
5.0/95.0	19.4 (134)	83.1 (573)	153.7 (67.6)	3.63	90.5 (1.6)
95.0/5.0	45.4 (313)	180.1 (1242)	138.2 (59.0)	2.89	148.0 (2.6)
218E/HFC-254eb					
5.0/95.0	19.8 (137)	84.3 (581)	153.5 (67.5)	3.63	91.9 (1.6)
95.0/5.0	45.5 (314)	180.2 (1242)	138.2 (59.0)	2.89	148.2 (2.6)
218E/HFC-263ca					
5.0/95.0	10.4 (72)	48.9 (337)	160.5 (71.4)	3.89	56.4 (1.0)
95.0/5.0	42.5 (293)	172.6 (1190)	139.0 (59.4)	2.94	144.0 (2.5)

218E/HFC-263fb						
5.0/95.0	31.2 (215)	122.8 (847)	154.2 (67.9)	3.52	131.5 (2.3)
95.0/5.0	47.6 (328)	185.8 (1281)	138.4 (59.1)	2.87	151.8 (2.7)
99/1	48.2(332)	188.7(1302)	137.7(58.7)	2.81	150.2(2.6)
96.3/3.7	47.8(329)	186.9(1289)	138.2(59.0)	2.85	151.3(2.7)
1/99	27.9(192)	120.6(832)	155.5(68.6)	3.26	116.9(2.1)
218E/HFC-272ca						
5.0/95.0	19.9 (137)	81.5 (562)	159.6 (70.9)	3.73	93.3 (1.6)
95.0/5.0	45.8 (316)	179.7 (1239)	138.7 (59.3)	2.92	150.1 (2.6)
218E/HFC-272ea						
5.0/95.0	12.0 (83)	55.6 (383)	168.4 (75.8)	3.96	65.9 (1.2)
95.0/5.0	44.5 (307)	177.2 (1222)	139.2 (59.6)	2.93	148.3 (2.6)
218E/HFC-272fb						
5.0/95.0	15.2(105)	67.7(467)	167.0(75.0)	3.86	78.9(1.4)
95.0/5.0	45.9(316)	180.6(1245)	139.0(59.4)	2.91	150.5(2.6)
218E/HFC-281ea						
5.0/95.0	27.4(189)	107.9(744)	167.0(75.0)	3.71	124.4(2.2)
95.0/5.0	48.6(335)	187.8(1295)	139.6(59.8)	2.91	156.6(2.8)
218E/HFC-281fa						
5.0/95.0	21.6(149)	90.0(621)	168.3(75.7)	3.76	104.1(1.8)
95.0/5.0	47.7(329)	185.3(1278)	139.6(59.8)	2.91	154.7(2.7)
218E2/HFC-32						
5.0/95.0	151.9 (1047)	516.9 (3564)	198.0 (92.2)	2.93	484.2 (8.5)
95.0/5.0	48.6 (335)	211.8 (1460)	140.9 (60.5)	3.43	197.4 (3.5)
218E2/HFC-125						
5.0/95.0*	60.8 (419)	228.6 (1576)	131.8 (55.4)	3.26	228.5 (4.0)
95.0/5.0	34.1 (235)	150.5 (1038)	131.9 (55.5)	2.97	123.1 (2.2)

* = evaporator temperature of 10.0°F, condenser temperature of 90.0°F, and return gas of 30.0°F

218E2/HFC-134					
95.0/5.0	33.1 (228)	145.8 (1005)	132.1 (55.6)	2.94	118.9 (2.1)
79.0/21.0	40.1 (276)	169.2 (1167)	140.9 (60.5)	3.06	147.0 (2.6)
46.1/53.9	46.5 (321)	184.9 (1275)	156.6 (69.2)	3.32	183.0 (3.2)
1.0/99.0	42.2 (291)	170.2 (1173)	182.0 (83.3)	3.58	188.8 (3.3)

218E2/HFC-134a

5.0/95.0	54.9 (379)	215.4 (1485)	169.0 (76.1)	3.40	222.7 (3.9)
95.0/5.0	33.6 (232)	148.2 (1022)	132.0 (55.6)	2.94	120.7 (2.1)
72/28	45.8(316)	189.8(1309)	143.0(61.7)	3.07	166.1(2.9)
24.7/75.3	55.8(385)	217.6(1501)	161.1(71.7)	3.30	215.6(3.8)
1/99	54.6(376)	214.3(1478)	170.6(77.0)	3.42	223.5(3.9)
218E2/HFC-143					
5.0/95.0	16.6 (114)	174.7 (515)	190.6 (88.1)	3.82	187.7 (1.5)
95.0/5.0	30.2 (208)	133.2 (918)	131.8 (55.4)	2.99	111.2 (2.0)
218E2/HFC-143a					
5.0/95.0*	108.9 (751)	363.2 (1067)	215.4 (56.8)	3.18	379.1 (2.3)
95.0/5.0	35.3 (243)	154.7 (1344)	134.3 (93.8)	3.02	129.2 (3.9)

* = subcool temperature of 20.0°F

218E2/HFC-152a					
5.0/95.0	51.3 (354)	194.9 (1344)	200.9 (93.8)	3.59	223.9 (3.9)
95.0/5.0	35.1 (242)	153.1 (1056)	134.5 (56.9)	2.99	127.5 (2.2)
81/19	45.1(311)	183.9(1268)	146.7(63.7)	3.16	167.7(3.0)
51.0/49.0	53.4(368)	203.8(1406)	168.7(75.9)	3.38	210.6(3.7)
1/99	50.9(351)	193.6(1335)	203.6(95.3)	3.60	223.5(3.9)
218E2/HFC-161					
5.0/95.0	80.2 (553)	281.3 (1940)	199.0 (92.8)	3.48	315.9 (5.6)
95.0/5.0	39.9 (275)	173.8 (1198)	137.8 (58.8)	3.05	147.2 (2.6)
78/22	63.2(436)	246.7(1702)	156.1(68.9)	3.11	224.5(4.0)
46.4/53.6	81.0(558)	285.4(1969)	175.4(80.2)	3.30	293.3(5.2)
1/99	79.9(551)	280.0(1932)	200.8(93.8)	3.49	316.7(5.6)
218E2/HFC-227ca					
5.0/95.0	36.0 (248)	142.5 (983)	142.0 (61.1)	3.19	133.1 (2.3)
95.0/5.0*	30.6 (211)	135.4 (934)	134.3 (56.8)	2.85	107.3 (1.9)

* = return gas temperature = 70.0°F.

218E2/HFC-227ea					
5.0/95.0	35.2 (243)	139.7 (963)	142.0 (61.1)	3.20	131.1 (2.3)
95.0/5.0*	30.5 (210)	135.2 (932)	134.3 (56.8)	2.85	107.2 (1.9)

* = return gas temperature = 70.0°F.

218E2/HFC-236ca					
5.0/95.0	13.4 (92)	63.6 (439)	150.1 (65.6)	3.60	66.5 (1.2)
95.0/5.0	28.2 (194)	128.0 (883)	129.9 (54.4)	2.96	104.5 (1.8)

218E2/HFC-236cb					
5.0/95.0	18.5 (128)	81.1 (559)	144.6 (62.6)	3.49	83.1 (1.5)
95.0/5.0	28.9 (215)	129.8 (895)	129.6 (54.2)	2.94	105.6 (1.9)
218E2/HFC-236fa					
5.0/95.0	20.4 (141)	88.0 (607)	144.3 (62.4)	3.45	89.4 (1.6)
95.0/5.0*	29.3 (202)	130.8 (902)	134.4 (56.9)	2.89	105.0 (1.8)
99/1	30.1(207)	134.3(926)	133.7(56.5)	2.84	105.8(1.9)
89.8/10.2	28.3(195)	126.7(874)	130.5(54.7)	2.98	105.1(1.8)
1/99	20.3(140)	87.0(600)	145.0(62.8)	3.47	89.0(1.6)

* = return gas temperature = 70.0°F.

218E2/HFC-245ca					
5.0/95.0	7.4 (51)	38.9 (268)	156.6 (69.2)	3.77	41.7 (0.7)
95.0/5.0	26.2 (181)	122.8 (847)	130.9 (54.9)	3.00	100.9 (1.8)
218E2/HFC-245cb					
5.0/95.0	35.9 (248)	137.1 (945)	138.5 (59.2)	3.29	135.0 (2.4)
95.0/5.0*	30.7 (212)	135.4 (934)	134.2 (56.8)	2.87	108.0 (1.9)

* = return gas temperature of 70.0°F

218E2/HFC-245ea					
5.0/95.0	7.4 (51)	39.7 (274)	161.2 (71.8)	3.81	42.8 (0.8)
95.0/5.0	26.6 (183)	123.9 (854)	130.9 (54.9)	2.99	102.0 (1.8)
218E2/HFC-245fa					
5.0/95.0	11.5 (79)	55.8 (385)	153.6 (67.6)	3.67	59.4 (1.0)
95.0/5.0	27.7 (191)	126.6 (873)	130.3 (54.6)	2.97	103.7 (1.8)
218E2/HFC-254ca					
5.0/95.0	7.2 (50)	37.4 (258)	159.9 (71.1)	3.81	40.8 (0.7)
95.0/5.0	25.9 (179)	121.4 (837)	131.1 (55.1)	3.02	100.6 (1.8)
218E2/HFC-254cb					
5.0/95.0	18.9 (130)	81.1 (897)	153.4 (54.6)	3.61	87.7 (1.9)
95.0/5.0	29.1 (201)	130.1 (569)	130.2 (67.4)	2.96	106.5 (1.6)
218E2/HFC-254eb					
5.0/95.0	19.2 (132)	82.5 (569)	153.3 (67.4)	3.60	88.9 (1.6)
95.0/5.0	29.1 (201)	130.0 (896)	130.1 (54.5)	2.96	106.8 (1.9)

218E2/HFC-263ca					
5.0/95.0	9.7 (67)	46.6 (321)	161.0 (71.7)	3.78	52.1 (0.9)
95.0/5.0	26.9 (185)	123.1 (849)	130.9 (54.9)	3.03	103.2 (1.8)
218E2/HFC-263fb					
5.0/95.0	30.6 (211)	120.7 (832)	153.8 (67.7)	3.52	129.1 (2.3)
95.0/5.0	30.5 (210)	134.3 (926)	130.4 (54.7)	2.95	110.3 (1.9)
99/1	30.6(211)	120.1(828)	154.0(67.8)	3.53	129.4(2.3)
60.5/39.5	30.8(212.5)	128.0(883)	140.5(60.3)	3.28	122.5(2.2)
1/99	30.6(211)	120.2(829)	154.6(68.1)	3.53	129.4(2.3)
218E2/HFC-272ca					
5.0/95.0	19.3 (133)	79.8 (550)	159.6 (70.9)	3.69	90.2 (1.6)
95.0/5.0	29.1 (201)	129.1 (890)	130.8 (54.9)	3.00	107.9 (1.9)
218E2/HFC-272ea					
5.0/95.0	11.2 (77)	52.9 (365)	169.5 (76.4)	3.82	60.2 (1.1)
95.0/5.0	27.9 (192)	125.7 (867)	131.3 (55.2)	3.02	106.0 (1.9)
218E2/HFC-272fb					
5.0/95.0	14.4 (99)	65.4 (451)	167.3 (75.2)	3.77	34.2 (1.3)
95.0/5.0	29.0 (200)	129.1 (890)	131.0 (55.0)	3.01	108.1 (1.9)
218E2/HFC-281ea					
5.0/95.0	26.8 (185)	105.9 (730)	166.8 (74.9)	3.69	121.5 (2.1)
95.0/5.0	31.0 (214)	135.2 (932)	131.9 (55.5)	2.99	113.5 (2.0)
218E2/HFC-281fa					
5.0/95.0	21.0 (145)	87.9 (606)	168.3 (75.7)	3.72	100.4 (1.8)
95.0/5.0	30.1 (208)	132.3 (912)	131.9 (55.5)	3.00	111.4 (2.0)
C-225eE$\alpha\beta$ /HFC-143					
55.9/44.1	16.9 (117)	75.2 (518)	167.9 (75.5)	3.73	84.6 (1.5)
5.0/95.0	16.1 (111)	72.6 (501)	191.7 (88.7)	3.80	84.8 (1.5)
95.0/5.0	16.8 (116)	74.4 (513)	148.8 (64.9)	3.60	79.6 (1.4)
C-225eE$\alpha\beta$ /HFC-236cb					
16.7/83.3	18.4 (127)	80.2 (553)	145.4 (63.0)	3.51	83.1 (1.5)
5.0/95.0	18.3 (126)	79.9 (551)	145.5 (63.1)	3.50	82.5 (1.5)
95.0/5.0	16.9 (117)	74.8 (516)	146.3 (63.5)	3.57	79.0 (1.4)
C-225eE$\alpha\beta$ /HFC-236ea					
91.5/8.5	16.6 (114)	73.9 (510)	146.6 (63.7)	3.58	78.2 (1.4)
5.0/95.0	15.4 (106)	70.5 (486)	150.2 (65.7)	3.57	73.7 (1.3)
95.0/5.0	16.7 (115)	73.9 (510)	146.4 (63.6)	3.58	78.3 (1.4)
C-225eE$\alpha\beta$ /HFC-245cb					

	22.4/77.6	30.8 (212)	122.2 (843)	140.9 (60.5)	3.38	123.6 (2.2)
	5.0/95.0	34.9 (241)	133.9 (923)	139.4 (59.7)	3.32	133.2 (2.3)
	95.0/5.0	17.5 (121)	76.9 (530)	145.9 (63.3)	3.59	81.7 (1.4)
	227caEαβ /HFC-32*					
	61/39	55.4(382)	257.2(1774)	149.6(65.3)	3.05	230.4(4.1)
	17.9/82.1	84.3(581)	312.6(2156)	158.1(70.1)	3.43	342.4(6.0)
	1/99	79.4(547.9)	511.6(3530)	225.3(107.4)	1.90	262.3(4.6)

*Condenser temp. 90°F, Evaporator temp. 10°F, and Return gas Temp. 30°F

227caEαβ /HFC-125					
5.0/95.0	111.8(771)	384.0(2648)	170.5(76.9)	2.75	318.0(5.6)
95.0/5.0	26.0(179)	113.8(785)	135.3(57.4)	3.28	106.6(1.9)
227caEαβ /HFC-134					
5.0/95.0	42.4(292)	170.3(1174)	179.7(82.1)	3.57	188.0(3.3)
95.0/5.0	24.7(170)	109.4(754)	136.1(57.8)	3.25	101.5(1.8)
227caEαβ /HFC-134a					
5.0/95.0	54.3(374)	212.9(1468)	169.2(76.2)	3.41	220.8(3.9)
95.0/5.0	25.1(173)	111.2(767)	135.7(57.6)	3.25	103.0(1.8)
227caEαβ /HFC-143					
5.0/95.0	16.4(113)	73.8(509)	190.7(88.2)	3.10	86.4(1.5)
95.0/5.0	22.6(156)	101.0(696)	136.4(58.0)	3.27	94.5(1.7)
227caEαβ /HFC-143a					
5.0/95.0	107.2(739)	359.0(2475)	216.0(102.2)	2.30	270.8(4.8)
95.0/5.0	27.1(187)	117.8(812)	137.6(58.7)	3.31	111.8(2.0)
227caEαβ /HFC-152a					
5.0/95.0	50.9(351)	193.4(1333)	201.1(93.9)	3.60	222.4(3.9)
95.0/5.0	26.4(182)	115.4(796)	138.0(58.9)	3.28	108.5(1.9)
227caEαβ /HFC-161					
5.0/95.0	79.7(550)	279.4(1926)	199.0(92.8)	3.48	314.7(5.5)
95.0/5.0	30.8(212)	131.4(906)	139.8(59.9)	3.34	126.1(2.2)
227caEαβ /HFC-227ca					
5.0/95.0	35.5(245)	141.0(972)	142.5(61.4)	3.19	131.7(2.3)
95.0/5.0	22.8(157)	102.7(708)	134.2(56.8)	3.20	93.1(1.6)
227caEαβ /HFC-227ea					
5.0/95.0	34.7(239)	138.3(954)	142.4(61.3)	3.20	129.8(2.3)
95.0/5.0	22.8(157)	102.6(707)	134.8(57.1)	3.20	93.1(1.6)

227caEαβ /HFC-236ca					
5.0/95.0	13.3(92)	62.9(433)	150.2(65.7)	3.60	65.8(1.2)
95.0/5.0	21.5(148)	97.3(671)	134.3(56.8)	3.24	89.6(1.6)
227caEαβ /HFC-236cb					
5.0/95.0	18.4(127)	80.3(554)	144.9(62.7)	3.49	82.4(1.4)
95.0/5.0	21.9(151)	99.0(682)	134.2(56.8	3.22	90.7(1.6)
227caEαβ /HFC-236fa					
5.0/95.0	20.1(140)	87.1(600)	144.5(62.5)	3.46	88.9(1.6)
95.0/5.0	22.1(152)	99.4(685)	134.1(56.7)	3.23	91.2(1.6)
227caEαβ /HFC-245ca					
5.0/95.0	7.4(51)	38.4(265)	156.6(69.2)	3.76	41.0(0.7)
95.0/5.0	20.4(141)	94.1(649)	134.9(57.2)	3.25	86.5(1.5)
227caEαβ /HFC-245cb					
5.0/95.0	35.4(244)	135,7(936)	139.0(59.4)	3.28	133.4(2.3)
95.0/5.0	22.9(158)	102.8(709)	134.1(56.7)	3.20	93.5(1.6)
1/99	36.0(248.4)	136.9(944)	139.0(59.4)	3.30	135.6(2.4)
8.1/91.9	35.0(241.5)	134.7(929)	138.8(59.3)	3.29	132.7(2.3)
82/18	24.8(171)	107.8(1743)	134.8(57.1)	3.25	100.6(1.8)
227caEαβ /HFC-245ea					
5.0/95.0	7.4(51)	39.1(269)	161.3(71.8)	3.78	41.9(0.7)
95.0/5.0	20.6(142)	94.7(653)	135.1(57.3)	3.24	87.0(1.5)
227caEαβ /HFC-245fa					
5.0/95.0	11.5(79)	54.7(377)	153.2(67.3)	3.68	58.7(1.0)
95.0/5.0	21.5(148)	96.4(664)	134.0(56.7)	3.29	90.2(1.6)
227caEαβ /HFC-254ca					
5.0/95.0	7.1(49)	36.9(254)	160.0(71.1)	3.78	40.0(0.7)
95.0/5.0	20.3(140)	93.3(643)	135.1(57.3)	3.26	86.2(1.5)
227caEαβ /HFC-254cb					
5.0/95.0	18.7(129)	80.5(555)	153.6(67.6)	3.61	87.0(1.5)
95.0/5.0	22.0(152)	98.9(682)	134.7(57.1	3.24	91.3(1.6)
227caEαβ /HFC-254eb					
5.0/95.0	19.0(131)	81.7(563)	153.5(67.5)	3.60	88.3(1.6)
95.0/5.0	22.0(152)	99.0(683)	134.7(57.1)	3.24	91.4(1.6)
227caEαβ /HFC-263ca					
5.0/95.0	9.7(67)	46.2(318)	161.1(71.7)	3.77	51.4(0.9)
95.0/5.0	20.8(143)	94.5(651)	135.1(57.3)	3.27	88.0(1.5)

227caEαβ/HFC-263fb					
5.0/95.0	30.3(209)	119.6(825)	154.1(67.8)	3.52	128.1(2.3)
95.0/5.0	22.9(158)	102.3(706)	135.0(57.2)	3.23	94.2(1.7)
227caEαβ/HFC-272ca					
5.0/95.0	19.2(132)	79.3(54.7)	159.8(71.0)	3.69	89.6(1.6)
95.0/5.0	22.2(153)	98.9(682)	135.4(57.4)	3.26	92.4(1.6)
99/1	22.3(153)	100.2(691)	133.8(56.6)	3.23	91.8(1.6)
94.3/5.7	22.1(152)	98.5(679)	135.5(57.5)	3.28	92.5(1.6)
1/99	19.1(131)	78.6(542)	160.4(71.3)	3.70	89.4(1.6)
227caEαβ/HFC-272ea					
5.0/95.0	11.1(76)	51.5(355)	168.6(75.9)	3.84	59.2(1.0)
95.0/5.0	21.4(148)	96.5(665)	135.7(57.6)	3.28	90.4(1.6)
227caEαβ/HFC-272fb					
5.0/95.0	14.3(98)	64.6(445)	167.4(75.2)	3.76	73.2(1.3)
95.0/5.0	21.9(151)	98.5(679)	135.7(51.6)	3.27	91.8(1.6)
227caEαβ/HFC-281ea					
5.0/95.0	26.6(184)	105.3(726)	167.0(75.0)	3.69	120.7(2.1)
95.0/5.0	23.4(162)	103.3(712)	136.3(57.9)	3.28	97.2(1.7)
99/1	22.5(155)	101.2(698)	134.1(56.7)	3.22	92.6(1.6)
31.5/68.5	26.8(184)	107.4(741)	160.6(71.4)	3.63	119.7(2.1)
1/99	26.6(183)	104.9(723)	167.8(75.4)	3.70	120.7(2.1)
227caEαβ/HFC-281fa					
5.0/95.0	20.8(144)	87.5(604)	168.6(75.9)	3.71	99.6(1.8)
95.0/5.0	22.8(157)	101.4(699)	136.3(57.9)	3.28	95.2(1.7)
99/1	22.4(154)	100.7(694)	134.0(56.7)	3.20	92.4(1.6)
84.3/15.7	23.4(161)	101.3(699)	141.8(61.0)	3.39	100.2(1.8)
1/99	20.7(142)	86.8(598)	169.3(76.3)	3.72	99.4(1.7)
227caEβγ/HFC-32					
5.0/95.0	152.1(1049)	517.0(3565)	198.4(924)	2.92	483.9(8.5)
95.0/5.0*	42.9(296)	190.1(1311)	152.0(66.7)	3.77	200.3(3.5)
67/33	98.9(682)	360.0(2484)	169.6(76.4)	3.35	365.6(6.4)
28.4/71.6*	159.9(1103)	477.2(3292)	176.6(80.3)	3.61	550.1(9.7)
1/99	150.1(1035)	512.2(3534)	199.9(93.3)	3.16	519.7(9.1)

* = subcool temperature of 20.0°F

227caEβγ/HFC-125					
5.0/95.0*	59.7(412)	226.0(1558)	132.8(56.0)	3.27	226.3(4.0)
95.0/5.0	30.3(209)	130.7(901)	141.8(61.0)	3.31	124.1(2.2)

* = evaporator temperature of 10.0°F, condenser temperature of 90.0°F, and return gas temperature of 30.0°F

227caEβγ/HFC-134					
95.0/5.0	29.2 (201)	126.5 (872)	142.3 (61.3)	3.27	118.7 (2.1)
76.0/24.0	37.1 (256)	152.2 (1049)	149.9 (65.5)	3.38	151.3 (2.7)
34.8/65.2	44.2 (305)	175.3 (1209)	166.9 (74.9)	3.46	184.2 (3.2)
1.0/99.0	42.2 (291)	170.0 (1172)	182.0 (83.3)	3.59	188.7 (3.3)
227caEβγ/HFC-134a					
5.0/95.0	54.7(377)	214.0(1475)	169.5(76.4)	3.41	222.2(3.9)
95.0/5.0	29.6(204)	128.5(886)	142.0(61.1)	3.27	120.7(2.1)
67/33	42.7(294)	175.0(1207)	152.2(66.8)	3.31	169.4(3.0)
1.9/98.1	54.6(376)	214.0(1476)	170.3(76.8)	3.43	223.2(3.9)
1/99	54.6(376)	214.0)1476)	170.7(77.1)	3.43	223.4(3.9)
227caEβγ/HFC-143					
5.0/95.0	16.5(114)	74.4(513)	191.4(88.6)	3.81	87.2(1.5)
95.0/5.0	26.9(185)	116.6(804)	142.2(61.2)	3.29	110.9(2.0)
227caEβγ/HFC-143a					
5.0/95.0*	107.8(743)	360.6(2486)	216.6(102.6)	3.18	377.2(6.6)
95.0/5.0	31.3(216)	134.3(926)	144.3(62.4)	3.35	129,6(2.3)

* = subcool temperature of 20.0°F

227caEβγ/HFC-152a					
5.0/95.0	51.0(352)	194.2(1339)	201.5(94.2)	3.59	223.1(3.9)
95.0/5.0	30.9(213)	132.6(914)	144.4(62.4)	3.31	126.6(2.2)
78/22	41.4(285)	167.0(1152)	157.6(69.8)	3.39	168.3(3.0)
38.3/61.7	51.4(354)	195.1(1346)	182.2(83.4)	3.50	213.6(3.8)
1/99	50.8(350)	193.4(1334)	203.6(95.3)	3.6	223.5(3.9)
227caEβγ/HFC-161					
5.0/95.0	80.0(552)	280.1(1931)	199.3(92.9)	3.48	315.6(5.6)
95.0/5.0	35.1(242)	149.6(1031)	146.9(63.8)	3.39	146.2(2.6)
72/28	60.9(420)	233.8(1613)	168.0(75.6)	3.32	234.0(4.1)
34.4/65.6	54.1(373)	247.5(1707)	180.6(82.6)	2.73	194.7(3.4)
1/99	79.8(550)	279.8(1930)	200.8(93.8)	3.49	316.7(5.6)
227caEβγ/HFC-227ca					
5.0/95.0	35.8(247)	141.8(978)	142.6(61.4)	3.20	133.1(2.3)
95.0/5.0	27.2(188)	118.5(817)	139.8(59.9)	3.23	109.8(1.9)

227caEβγ/HFC-227ea						
	5.0/95.0	35.0(241)	139.0(958)	142.6(61.4)	3.21	131.0(2.3)
	95.0/5.0	27.2(188)	118.3(816)	139.7(59.8)	3.23	109.7(1.9)
227caEβγ/HFC-236ca						
	5.0/95.0	13.4(92)	63.9(441)	150.7(65.9)	3.60	66.4(1.2)
	95.0/5.0	25.5(176)	112.6(776)	140.3(60.2)	3.27	105.5(1.9)
227caEβγ/HFC-236cb						
	5.0/95.0	18.5 (129)	80.9 (578)	145.3 (62.9)	3.49	82.9 (1.5)
	95.0/5.0	26.1 (180)	114.3 (788)	139.9 (59.9)	3.25	106.7 (1.9)
227caEβγ/HFC-236fa						
	5.0/95.0	20.4(141)	87.6(604)	144.9(62.7)	3.46	89.5(1.6)
	95.0/5.0	26.3(181)	114.9(792)	139.8(59.9)	3.26	107.3(1.9)
227caEβγ/HFC-245ca						
	5.0/95.0	7.4 (51)	38.8 (268)	157.1 (69.5)	3.78	41.7 (0.7)
	95.0/5.0	24.0 (165)	108.6 (749)	141.2 (60.7)	3.29	102.0 (1.8)
227caEβγ/HFC-245cb						
	5.0/95.0	35.7 (246)	136.4 (940)	139.1 (59.5)	3.30	134.7 (2.4)
	95.0/5.0	27.3 (188)	118.4 (816)	139.6 (59.8)	3.24	110.1 (1.9)
227caEβγ/HFC-245ea						
	5.0/95.0	7.4 (51)	39.6 (273)	161.8 (72.1)	3.81	42.7 (0.8)
	95.0/5.0	24.3 (168)	109.5 (755)	141.2 (60.7)	3.29	102.8 (1.8)
227caEβγ/HFC-245fa						
	5.0/95.0	11.5 (79)	55.7 (384)	153.2 (67.3)	3.68	59.5 (1.0)
	95.0/5.0	25.2 (174)	111.5 (769)	139.5 (59.7)	3.29	105.1 (1.8)
227caEβγ/HFC-254ca						
	5.0/95.0	7.2 (50)	37.3 (257)	160.5 (71.4)	3.81	40.6 (0.7)
	95.0/5.0	23.8 (164)	107.7 (743)	141.4 (60.8)	3.31	101.6 (1.8)
227caEβγ/HFC-254cb						
	5.0/95.0	18.8 (130)	81.0 (558)	153.9 (67.7)	3.61	87.7 (1.5)
	95.0/5.0	26.1 (180)	114.1 (787)	142.4 (60.2)	3.27	107.4 (1.9)
227caEβγ/HFC-254eb						
	5.0/95.0	19.2(132)	82.2(567)	153.8(67.7)	3.61	89.0(1.6)
	95.0/5.0	26.2(181)	114.4(789)	140.3(60.2)	3.28	107.8(1.9)
227caEβγ/HFC-263ca						
	5.0/95.0	9.7 (67)	46.5 (321)	161.5 (71.9)	3.78	52.0 (0.9)

	95.0/5.0	24.5 (169)	109.1 (752)	141.2 (60.7)	3.31	103.4 (1.8)
	227caEβγ/HFC-263fb					
	5.0/95.0	30.5 (210)	120.1 (828)	154.3 (67.9)	3.52	128.9 (2.3)
	95.0/5.0	27.2 (188)	117.8 (812)	140.6 (60.3)	3.26	110.6 (1.9)
	99/1	26.9(185)	117.3(809)	139.7(59.8)	3.24	109.1(1.9)
	32.9/67.1	29.9(206)	120.2(829)	150.9(66.1)	3.47	125.4(2.2)
	1/99	30.6(211)	120.1(828)	154.7(68.2)	3.53	129.3(2.3)
	227caEβγ/HFC-272ca					
	5.0/95.0	19.3 (133)	79.5 (548)	159.9 (71.1)	3.70	90.2 (1.6)
	95.0/5.0	26.2 (181)	113.7 (784)	140.9 (60.5)	3.30	108.2 (1.9)
	99/1	26.7(184)	116.6(204)	139.8(159)	3.25	108.6(1.9)
	89.0/11.0	25.5(176)	109.7(756)	142.6(61.4)	3.36	107.3(1.9)
	1/99	19.1(131)	78.7(543)	160.5(71.4)	3.70	89.5(1.6)
	227caEβγ/HFC-272ea					
	5.0/95.0	11.1 (77)	52.7 (363)	169.9 (76.6)	3.82	60.0 (1.1)
	95.0/5.0	25.3 (174)	111.1 (766)	141.4 (60.8)	3.32	106.1 (1.9)
	227caEβγ/HFC-272fb					
	5.0/95.0	14.4 (99)	65.1 (449)	167.8 (75.4)	3.77	73.9 (1.3)
	95.0/5.0	26.0 (179)	113.4 (782)	141.3 (60.7)	3.30	107.9 (1.9)
	227caEβγ/HFC-281ea					
	5.0/95.0	26.7 (184)	105.7 (729)	167.3 (75.2)	3.69	121.1 (2.1)
	95.0/5.0	27.7 (191)	118.8 (819)	142.0 (61.1)	3.28	113.0 (2.0)
	99/1	27.0(186)	117.6(811)	140.0(60.0)	3.25	109.6(1.9)
	73.1/26.9	28.9(199)	118.6(818)	150.6(65.9)	3.46	122.7(2.2)
	1/99	26.6(183)	105.0(724)	167.9(75.5)	3.69	120.8(2.1)
	227caEβγ/HFC-281fa					
	5.0/95.0	20.9 (144)	87.8 (605)	168.7 (75.9)	3.72	100.2 (1.8)
	95.0/5.0	27.0 (186)	116.5 (803)	141.9 (61.1)	3.30	111.1 (2.0)
	99/1	26.9(185)	117.2(808)	140.0(60.0)	3.25	109.3(1.9)
	85.9/14.1	26.8(184)	113.6(783)	145.9(63.2)	3.40	113.3(2.0)
	1/99	20.7(142)	86.9(599)	169.4(76.3)	3.72	99.4(1.7)
	227eaE/HFC-32					
	5.0/95.0	152.1 (1049)	516.9 (3564)	198.3 (92.4)	2.93	484.1 (8.5)
	95.0/5.0*	45.3 (312)	196.1 (1352)	151.3 (66.3)	3.77	208.1 (3.7)
	68/32**	51.2(353)	240.8(1661)	144.4(62.4)	3.26	228.0(4.0)
	30.0/70.0	160.9(1110)	479.0(3305)	175.8(79.9)	3.60	549.5(9.7)
	1/99	150.1(1035)	512.3(3534)	199.8(93.2)	3.16	519.7(9.1)

*Subcool temp. 20.0°F

**Subcool temp. 20°F, Return gas temp. 30°F

227eaE/HFC-125					
5.0/95.0*	60.0 (414)	226.5 (1562)	132.6 (55.9)	3.27	227.1 (4.0)
95.0/5.0	31.8 (219)	135.8 (936)	141.8 (61.0)	3.29	128.0 (2.3)

* = evaporator temperature of 10.0°F, condenser temperature of 90.0°F, and return gas temperature of 30.0°F

227eaE/HFC-134					
95.0/5.0	30.7 (211)	131.9 (909)	142.3 (61.3)	3.24	122.9 (2.2)
78.0/22.0	37.2 (256)	154.6 (1066)	149.9 (65.5)	3.29	148.8 (2.6)
38.2/61.8	44.8 (309)	177.0 (1220)	165.5 (74.2)	3.44	184.5 (3.2)
1.0/99.0	42.2 (291)	170.0 (1172)	182.0 (83.3)	3.59	188.8 (3.3)
227eaE/HFC-134a					
5.0/95.0	54.7 (377)	214.3 (1478)	169.5 (76.4)	3.41	222.5 (3.9)
95.0/5.0	31.1 (214)	134.0 (924)	142.1 (61.2)	3.24	124.6 (2.2)
70/30	43.0(296)	175.6(1211)	151.0(66.1)	3.29	168.8(3.0)
9.3/90.7	54.8(378)	214.3(1478)	168.2(75.7)	3.40	221.1(3.9)
1/99	54.6(376)	214.1(1477)	170.6(77.0)	3.43	223.5(3.9)
227eaE/HFC-143					
5.0/95.0	16.6 (114)	74.6 (514)	191.3 (88.5)	3.81	87.4 (1.5)
95.0/5.0	28.3 (195)	121.7 (839)	142.2 (61.2)	3.27	115.0 (2.0)
227eaE/HFC-143a					
5.0/95.0*	108.1 (745)	361.2 (2490)	216.5 (102.5)	3.18	377.9 (6.7)
95.0/5.0	32.8 (226)	139.6 (963)	144.4 (62.4)	3.32	133.4 (2.3)

* = subcool temperature of 20.0°F

227eaE/HFC-152a					
5.0/95.0	51.1 (352)	194.5 (1341)	201.6 (94.2)	3.59	223.3(3.9)
95.0/5.0	32.5 (224)	138.1 (952)	144.5 (62.5)	3.28	130.8 (2.3)
80/20	42.1(290)	169.3(1168)	156.1(68.9)	3.36	168.9(3.0)
42.1/57.9	52.1(359)	197.3(1361)	179.9(82.2)	3.48	213.7(3.8)
1/99	50.8(350)	193.5(1335)	203.7(95.4)	3.60	223.5(3.9)
227eaE/HFC-161					
5.0/95.0	80.0 (552)	280.3 (1933)	199.3 (92.9)	3.48	315.8 (5.6)
95.0/5.0	36.7 (253)	155.1 (1069)	146.9 (63.8)	3.36	150.1 (2.6)
73/27	61.8(426)	236.3(1630)	167.1(75.1)	3.30	235.0(4.1)
37.5/62.5	79.3(547)	278.3(1920)	185.1(85.1)	3.38	298.1(5.2)
1/99	79.8(550)	279.8(1930)	200.8(93.8)	3.49	316.7(5.6)

227eaE/HFC-227ca

	5.0/95.0	35.9 (248)	142.0 (979)	142.6 (61.4)	3.20	133.3 (2.3)
	95.0/5.0	28.7 (198)	123.6 (852)	139.7 (59.8)	3.21	113.9 (2.0)
	227eaE/HFC-227ea					
	5.0/95.0	35.1 (242)	139.1 (959)	142.6 (61.4)	3.21	131.1 (2.3)
	95.0/5.0	28.6 (197)	123.3 (850)	139.7 (59.8)	3.21	113.7 (2.0)
	227eaE/HFC-236ca					
	5.0/95.0	13.4 (92)	63.5 (438)	150.7 (65.9)	3.60	66.5 (1.2)
	95.0/5.0	26.7 (184)	117.4 (809)	140.3 (60.2)	3.25	109.3 (1.9)
	227eaE/HFC236cb					
	5.0/95.0	18.5 (128)	81.0 (558)	145.2 (62.9)	3.49	83.3 (1.5)
	95.0/5.0	27.5 (190)	119.3 (823)	139.8 (59.9)	3.24	111.0 (2.0)
	227eaE/HFC-236fa					
	5.0/95.0	20.4 (141)	87.8 (605)	144.9 (62.7)	3.46	89.6 (1.6)
	95.0/5.0	27.6 (190)	119.9 (827)	139.8 (59.9)	3.24	111.3 (2.0)
	227eaE/HFC-245ca					
	5.0/95.0	7.5 (52)	38.9 (268)	157.1 (69.5)	3.78	41.9 (0.7)
	95.0/5.0	25.2 (174)	113.4 (782)	141.3 (60.7)	3.27	105.6 (1.9)
	227eaE/HFC-245cb					
	5.0/95.0	35.8 (247)	136.6 (942)	139.0 (59.4)	3.30	134.9 (2.4)
	95.0/5.0	28.7 (198)	123.5 (852)	139.6 (59.8)	3.22	114.2 (2.0)
	227eaE/HFC-245ea					
	5.0/95.0	7.4 (51)	39.7 (274)	161.9 (72.2)	3.81	42.9 (0.8)
	95.0/5.0	25.6 (177)	114.3 (788)	141.2 (60.7)	3.27	106.7 (1.9)
	227eaE/HFC-245fa					
	5.0/95.0	11.6 (80)	55.8 (385)	154.2 (67.9)	3.67	59.6 (1.0)
	95.0/5.0	26.4 (182)	116.4 (803)	140.6 (60.3)	3.26	108.6 (1.9)
	227eaE/HFC-254ca					
	5.0/95.0	7.2 (50)	37.4 (258)	160.4 (71.3)	3.81	40.9 (0.7)
	95.0/5.0	25.0 (172)	112.4 (775)	141.4 (60.8)	3.28	105.3 (1.9)
	227eaE/HFC-254cb					
	5.0/95.0	18.9 (130)	81.1 (559)	153.9 (67.7)	3.61	87.8 (1.5)
	95.0/5.0	27.5 (190)	119.4 (823)	140.5 (60.3)	3.25	111.2 (2.0)
	227eaE/HFC-254eb					
	5.0/95.0	19.2 (132)	82.3 (567)	153.8 (67.7)	3.61	89.1 (1.6)
	95.0/5.0	27.5 (190)	119.2 (822)	140.4 (60.2)	3.25	111.4 (2.0)

227eaE/HFC-263ca					
5.0/95.0	9.8 (68)	46.7 (322)	161.5 (71.9)	3.78	52.2 (0.9)
95.0/5.0	25.7 (177)	113.8 (785)	141.2 (60.7)	3.29	107.3 (1.9)
227eaE/HFC-263fb					
5.0/95.0	30.5 (210)	120.3 (829)	154.3 (67.9)	3.52	129.0 (2.3)
95.0/5.0	28.6 (197)	122.7 (846)	140.6 (60.3)	3.24	114.6 (2.0)
99/1	28.4(194)	122.7(846)	139.7(59.8)	3.22	113.4(2.0)
49.3/50.7	30.0(207)	121.8(840)	148.5(64.7)	3.42	124.4(2.2)
1/99	30.6(211)	120.1(828)	154.7(68.2)	3.53	129.3(2.3)
227eaE/HFC-272ca					
5.0/95.0	19.3 (133)	79.5 (548)	159.9 (71.1)	3.70	90.2 (1.6)
95.0/5.0	27.4 (189)	118.1 (814)	141.0 (60.6)	3.27	111.6 (2.0)
99/1	28.2(194)	121.8(840)	139.9(59.9)	3.22	112.6(2.0)
90.7/9.3	26.7(184)	114.4(789)	142.1(61.2)	3.33	110.8(2.0)
29/71	20.6(142)	85.4(589)	156.1(68.9)	3.66	95.0(1.7)
227eaE/HFC-272ea					
5.0/95.0	11.2 (77)	52.8 (364)	169.9 (76.6)	3.82	60.2 (1.0)
95.0/5.0	26.6 (183)	116.1 (800)	141.6 (60.9)	3.29	109.8 (1.9)
227eaE/HFC-272fb					
5.0/95.0	14.4 (99)	65.2 (450)	167.8 (75.4)	3.77	73.9 (1.3)
95.0/5.0	27.3 (188)	118.3 (816)	141.3 (60.7)	3.28	111.9 (2.0)
227eaE/HFC-281ea					
5.0/95.0	26.7 (184)	105.8 (729)	167.3 (75.2)	3.68	121.2 (2.1)
95.0/5.0	29.1 (201)	123.7 (853)	141.9 (61.0)	3.27	117.1 (2.1)
99/1	28.5(196)	123.0(848)	140.0(60.0)	3.23	113.9(2.0)
76.8/23.2	29.8(205)	122.1(842)	149.2(65.1)	3.43	124.9(2.2)
1/99	26.6(183)	105.1(725)	167.9(75.5)	3.59	120.8(2.1)
227eaE/HFC-281fa					
5.0/95.0	21.0 (145)	87.9 (606)	168.6 (75.9)	3.72	100.5 (1.8)
95.0/5.0	28.4 (196)	121.5 (838)	141.9 (61.0)	3.28	115.3 (2.0)
99/1	28.4(196)	122.5(845)	140.0(60.0)	3.23	113.6(2.0)
87.6/12.4	20.7(142)	86.7(598)	169.2(76.2)	3.73	99.6(1.8)
1/99	20.7(142)	87.0(600)	169.4(76.3)	3.72	99.5(1.8)
C-234fE$\alpha\beta$ /HFC-245cb					
13.5/86.5	29.3 (202)	119.3 (823)	142.1 (61.2)	3.38	119.8 (2.1)
5.0/95.0	33.5 (231)	130.5 (900)	140.1 (60.1)	3.33	130.0 (2.3)
95.0/5.0	9.4 (65)	45.5 (314)	151.4 (66.3)	3.76	50.0 (0.9)
C-234fE$\alpha\beta$ /HFC-245eb					
49.1/50.9	11.6 (80)	55.7 (384)	152.3 (66.8)	3.67	59.5 (1.0)

	5.0/95.0	8.6 (59)	43.2 (298)	156.3 (69.1)	3.71	46.2 (0.8)
	95.0/5.0	8.6 (59)	41.9 (289)	152.6 (67.0)	3.73	45.5 (0.8)
	C-234fE$\alpha\beta$/HFC-356mff					
	59.0/41.0	9.1 (63)	44.6 (308)	145.3 (62.9)	3.64	46.9 (0.8)
	5.0/95.0	7.6 (52)	39.4 (272)	138.4 (59.1)	3.55	39.1 (0.7)
	95.0/5.0	8.6 (59)	42.2 (291)	151.5 (66.4)	3.72	45.7 (0.8)
	C-234fE$\alpha\beta$/HFC-356mmz					
	50.1/49.9	9.9 (68)	47.1 (325)	143.4 (61.9)	3.62	49.5 (0.9)
	5.0/95.0	8.7 (60)	43.2 (298)	137.5 (58.6)	3.54	43.4 (0.8)
	95.0/5.0	8.7 (60)	42.5 (293)	151.4 (66.3)	3.73	46.2 (0.8)
	C-234fE$\beta\gamma$/HFC-245ca					
	33.6/66.4	7.2 (50)	37.0 (255)	156.3 (69.1)	3.74	39.7 (0.7)
	5.0/95.0	7. 0 (48)	36.7 (253)	157.8 (69.9)	3.74	39.2 (0.7)
	95.0/5.0	6.6 (46)	33.9 (234)	154.5 (68.1)	3.76	36.7 (0.6)
	C-234fE$\beta\gamma$/HFC-245cb					
	10.2/89.8	29.5 (203)	120.8 (833)	142.3 (61.3)	3.36	120.3 (2.1)
	5.0/95.0	32.8 (226)	129.0 (889)	140.5 (60.3)	3.33	128.5 (2.3)
	95.0/5.0	7.5 (52)	37.7 (260)	153.0 (67.2)	3.89	42.4 (0.7)
	C-234fE$\beta\gamma$/HFC-245ea					
	36.0/64.0	7.0 (48)	36.9 (254)	159.5 (70.8)	3.76	39.6 (0.7)
	5.0/95.0	6.9 (48)	37.2 (256)	162.6 (72.6)	3.77	39.7 (0.7)
	95.0/5.0	6.6 (46)	33.9 (234)	154.8 (68.2)	3.76	36.7 (0.6)
	C-234fE$\beta\gamma$/HFC-254ca					
	36.0/64.0	6.9 (48)	35.6 (245)	158.6 (70.3)	3.77	38.6 (0.7)
	5.0/95.0	6.8 (47)	35.3 (243)	161.1 (71.7)	3.77	38.1 (0.7)
	95.0/5.0	6.6 (46)	33.8 (233)	154.7 (68.2)	3.76	36.7 (0.6)
	C-234fE$\beta\gamma$/HFC-356mff					
	43.1/56.9	7.8 (54)	39.7 (274)	143.9 (62.2)	3.63	41.1 (0.7)
	5.0/95.0	7.4 (51)	38.8 (268)	138.5 (59.2)	3.55	38.4 (0.7)
	95.0/5.0	6.7 (46)	34.3 (236)	153.4 (67.4)	3.76	37.1 (0.7)
	C-234fE$\beta\gamma$/HFC-356mmz					
	35.8/64.2	8.4 (58)	41.5 (286)	142.4 (61.3)	3.61	43.0 (0.8)
	5.0/95.0	8.5 (59)	42.2 (291)	137.6 (58.7)	3.54	42.4 (0.7)
	95.0/5.0	6.7 (46)	34.3 (236)	153.3 (67.4)	3.76	37.2 (0.7)
	236caE/HFC-245ca					
	5.0/95.0	7.0 (48)	36.6 (252)	157.7 (69.8)	3.74	39.0 (0.7)
	50.0/50.0	6.7 (46)	36.5 (252)	154.4 (68.0)	3.71	37.8 (0.7)

95.0/5.0	6.2 (43)	35.7 (246)	150.9 (66.1)	3.67	35.7 (0.6)
236caE/HFC-254ca					
99/1	6.2(42)	35.5(245)	150.6(65.9)	3.67	35.5(2.0)
17.6/82.4	6.7(46)	35.4(244)	159.9(71.1)	3.76	37.9(1.8)
1/99	6.7(46)	35.2(242)	161.4(71.9)	3.77	38.0(1.8)
236eaE$\beta\gamma$/HFC-263ca					
99/1	7.7(53)	42.5(293)	149.3(65.2)	3.64	42.6(0.7)
4.1/95.9	9.3(64)	44.8(309)	162.0(72.2)	3.77	49.8(0.9)
1/99	9.4(64)	44.8(309)	162.3(72.4)	3.77	49.9(0.9)
236eaE$\beta\gamma$/HFC-338mf					
99/1	7.7(53)	42.7(294)	148.9(64.9)	3.64	42.7(0.8)
92.6/7.4	8.0(55)	43.8(302)	147.5(64.2)	3.63	43.9(0.8)
1/99	9.7(66)	48.3(333)	131.1(55.1)	3.39	45.8(0.8)
236eaE$\beta\gamma$/HFC-356mmz					
99/1	7.7(53)	42.5(293)	149.0(65.0)	3.64	42.6(0.7)
15.1/84.9	8.6(59)	43.2(298)	138.3(59.1)	3.53	43.1(0.8)
1/99	8.4(58)	42.0(289)	136.9(58.3)	3.53	42.2(0.7)
236faE/HFC-32					
55/45*	80.8(557)	320.8(2213)	181.3(82.9)	3.62	352.9(6.2)
8.5/91.5	149.2(1029)	506.5(3494)	196.7(91.5)	2.96	479.3(8.4)
1/99	149.6(1032)	510.4(3521)	199.8(93.2)	3.16	518.3(9.1)
*Subcool temp. 25°F					
236faE/HFC-272ca					
99/1	15.7(108)	74.5(514)	142.3(61.3)	3.46	73.7(1.3)
27.8/72.2	18.6(128)	78.2(539)	156.9(69.4)	3.67	87.1(1.5)
1/99	19.1(131)	78.5(541)	160.5(71.4)	3.70	89.3(1.6)
236faE/HFC-272fb					
99/1	15.6(107)	74.3(512)	142.4(61.3)	3.47	73.6(1.3)
82.3/17.7	15.7(108)	73.2(505)	148.1(64.5)	3.55	75.4(1.3)
1/99	14.0(96)	63.5(438)	168.7(75.9)	3.76	72.0(1.3)
236faE/HFC-281fa					
99/1	15.8(109)	75.1(517)	142.5(61.4)	3.47	74.3(1.3)
9.3/90.7	20.6(142)	86.7(598)	167.9(75.5)	3.72	98.9(1.7)
1/99	20.7(142)	86.7(598)	169.3(76.3)	3.73	99.3(1.7)

EXAMPLE 4

The following table shows the refrigerant performance of various compositions. The data are based on the following conditions.

Evaporator temperature 40.0°F (4.4°C)
Condenser temperature 100.0°F (37.8°C)
Compressor efficiency is 75%.
Return gas temperature 60.0°F

TABLE 5

Refrig. Comp.	Evap. Press. Psia (kPa)	Cond. Press. Psia (kPa)	Comp. Dis. Temp. °F (°C)	COP	Capacity BTU/min (kw)
CFC-11	7.1 (49)	23.5 (162)	130.0 (54.4)	5.68	44.2 (0.8)
134E/HFC-32					
5.0/95.0	135.9 (937)	483.2 (3331)	202.5 (94.7)	3.17	490.0 (8.6)
95.0/5.0	21.1 (145)	95.6 (659)	175.8 (79.9)	4.08	116.8 (2.1)
134E/HFC-125*					
5.0/95.0	107.4(741)	387.9(2675)	154.0(67.8)	2.13	244.0(4.3)
95.0/5.0	23.7(163)	63.5(438)	126.4(42.4)	7.10	146.9(2.6)

* = Condenser temp. of 130°F, evaporator temp. of 45°F, and return gas temp. of 65°F

134E/HFC-134					
5.0/95.0	36.3(250)	104.9(723)	127.1(52.8)	5.38	184.8(3.2)
95.0/5.0	15.2(105)	50.5(348)	119.5(48.6)	5.53	90.5(1.6)
134E/HFC-134a					
5.0/95.0	46.8(323)	132.8(916)	118.5(48.1)	5.20	222.8(3.9)
95.0/5.0	15.7(108)	51.8(357)	119.9(48.8)	5.57	93.5(1.6)
134E/HFC-143					
5.0/95.0	14.5 (100)	45.2 (312)	134.5 (56.9)	5.60	84.0 (1.5)
37.9/62.1	14.7 (101)	46.7 (322)	128.9 (53.8)	5.57	85.7 (1.5)
95.0/5.0	14.4 (99)	48.0 (331)	119.0 (48.3)	5.51	85.7 (1.5)
134E/HFC-143a					
5.0/95.0	101.0(696)	247.9(1709)	149.7(65.4)	4.84	394.9(6.9)
95.0/5.0	23.9(165)	69.4(479)	133.2(56.2)	6.54	148.0(2.6)

134E/HFC-152a						
5.0/95.0	44.5(307)	122.9(847)	142.8(61.6	5.39	220.3(3.9)
95.0/5.0	16.1(111)	52.8(364)	121.7(49.8)	5.57	95.4(1.7)
134E/HFC-161						
5.0/95.0	70.2(484)	181.9(1254)	141.2(60.7)	5.28	317.3(5.6)
95.0/5.0	18.1(125)	58.3(402)	125.4(51.9)	5.69	108.0(1.9)
134E/HFC-227ca						
5.0/95.0	35.1 (242)	97.7 (674)	102.2 (39.0)	4.88	149.7 (2.6)
13.6/86.4	37.4 (258)	103.4 (713)	99.6 (37.6)	4.92	160.1 (2.8)
134E/HFC-227ea						
5.0/95.0	34.3(237)	95.8(661)	102.3(39.1)	4.89	147.5(2.6)
95.0/5.0	18.9(130)	57.1(394)	122.6(50.3)	6.16	114.7(2.0)
7.3/92.7*	36.0 (248)	141.7 (977)	144.5 (62.5)	3.24	135.5 (2.4)

* = Condenser = 130°F, evaporator = 45°F, and return gas = 65°F.

134E/HFC-236ca					
5.0/95.0	12.7(87)	40.6(280)	105.8(41.0)	5.41	70.5(1.2)
95.0/5.0	15.0(103)	49.8(343)	117.8(47.7)	5.52	88.9(1.6)
99/1	13.5(93)	44.8(309)	142.3(61.3)	5.59	81.5(1.4)
78.0/22.0	14.2(98)	46.2(318)	137.7(58.7)	5.57	83.5(1.5)
1/99	11.8(81)	62.1(428)	152.1(66.7)	3.33	58.0(1.0)
134E/HFC-236cb					
5.0/95.0	17.7 (122)	53.5 (369)	101.2 (38.4)	5.28	90.4 (1.6)
36.3/63.7	22.3 (154)	66.2 (456)	104.1 (40.1)	5.26	111.8 (2.0)
95.0/5.0	15.8 (109)	51.6 (356)	118.0 (47.8)	5.61	93.8 (1.7)
134E/HFC-236ea					
5.0/95.0	14.7 (101)	46.2 (319)	104.9 (40.5)	5.36	79.4 (1.4)
52.8/47.2	19.1 (132)	59.2 (408)	108.9 (42.7)	5.35	102.2 (1.8)
95.0/5.0	15.2 (105)	50.2 (346)	118.0 (47.8)	5.54	90.0 (1.6)
134E/HFC-236fa					
5.0/95.0	19.5(135)	58.3(402)	100.7(38.2)	5.25	97.7(1.7)
95.0/5.0	16.1(111)	52.0(359)	119.1(48.4)	5.65	95.3(1.7)
14.2/85.8*	21.2 (146)	91.1 (628)	148.6 (64.8)	3.50	94.3 (1.7)

* = Condenser = 130°F, evaporator = 45°F, and return gas = 65°F.

134E/HFC-245ca					
5.0/95.0	6.9(47)	23.9(164)	111.7(44.3)	5.58	42.7(0.8)
95.0/5.0	14.4(99)	47.9(331)	117.2(47.3)	5.50	85.2(1.5)

134E/HFC-245cb					
5.0/95.0	33.5 (231)	91.5 (631)	104.4 (40.2)	4.90	142.1 (2.5)
28.5/71.5	32.8 (226)	91.8 (633)	103.6 (39.8)	5.03	147.3 (2.6)
95.0/5.0	16.5 (114)	53.1 (366)	119.5 (48.6)	5.69	97.9 (1.7)
134E/HFC-245ea					
5.0/95.0	6.7(46)	23.7(164)	115.2(46.2)	5.59	42.5(0.7)
95.0/5.0	14.2(98)	47.6(328)	117.6(47.6)	5.49	84.5(1.5)
134E/HFC-245fa					
5.0/95.0	10.7(74)	35.0(241)	108.2(42.3)	5.46	61.5(1.1)
95.0/5.0	14.6(101)	49.2(339)	117.8(47.7)	5.44	86.4(1.5)
134E/HFC-254ca					
5.0/95.0	6.5(45)	22.5(155)	113.5(45.3)	5.59	40.5(0.7)
95.0/5.0	14.1(97)	47.4(327)	117.6(47.6)	5.48	84.1(1.5)
134E/HFC-254cb					
5.0/95.0	17.4 (120)	52.0 (359)	107.1 (41.7)	5.39	90.8 (1.6)
29.7/70.3	19.4 (134)	58.0 (400)	108.5 (42.5)	5.39	101.2 (1.8)
95.0/5.0	15.2 (105)	50.4 (347)	118.1 (47.8)	5.53	90.1 (1.6)
134E/HFC-254eb *					
28.6/71.4	19.0 (131)	82.9 (572)	159.2 (70.7)	3.64	90.4 (1.6)
134E/HFC-263ca					
5.0/95.0	8.8(61)	28.6(197)	113.5(45.3)	5.57	51.9(0.9)
95.0/5.0	14.4(99)	47.8(330)	117.4(47.4)	5.50	85.1(1.5)
134E/HFC-263fb					
5.0/95.0	28.0(193)	78.8(543)	106.5(41.4)	5.28	134.1(2.4)
95.0/5.0	16.1(111)	52.5(362)	119.4(48.6)	5.60	95.2(1.7)
134E/HFC-272ca					
5.0/95.0	17.5(121)	51.2(353)	111.7(44.3)	5.44	91.0(1.6)
95.0/5.0	15.2(105)	50.0(345)	118.0(47.8)	5.51	89.3(1.6)
134E/HFC-272ea					
5.0/95.0	9.8(67)	32.1(221)	119.8(48.8)	5.52	57.7(1.0)
95.0/5.0	14.1(97)	47.3(326)	118.1(47.8)	5.50	84.1(1.5)

* = Condenser = 130°F, evaporator = 45°F, and return gas = 65°F.

134E/HFC-272fb						
5.0/95.0	12.7(88)	40.1(276)	117.5(47.5)	5.51	72.3(1.3)
95.0/5.0	14.4(100)	48.2(332)	117.9(47.7)	5.50	85.8(1.5)
134E/HFC-281ea						
5.0/95.0	24.0(166)	67.9(468)	116.7(47.1)	5.47	121.8(2.1)
95.0/5.0	15.5(107)	51.0(351)	118.8(48.2)	5.52	91.3(1.6)
134E/HFC-281fa						
5.0/95.0	18.7(129)	55.3(381)	117.1(47.3)	5.50	99.8(1.8)
95.0/5.0	15.2(105)	49.6(342)	118.0(47.8)	5.57	89.7(1.6)
134E/HFC-338mf						
5.0/95.0	10.5 (72)	34.7 (239)	95.3 (35.2)	5.35	58.5 (1.0)
65.5/34.5	18.8 (130)	59.8 (412)	108.2 (42.3)	5.21	99.7 (1.8)
95.0/5.0	15.7 (108)	51.6 (356)	118.1 (47.8)	5.62	93.1 (1.6)
236caE/HFC-125						
5.0/95.0	90.0(621)	242.9(1675)	127.5(53.1)	4.33	330.6(5.8)
95.0/5.0	9.0(62)	30.8(212)	119.3(48.5)	6.26	61.3(1.1)
236caE/HFC-134						
5.0/95.0	35.3(243)	103.9(716)	129.2(54.0)	5.28	179.7(3.2)
95.0/5.0	6.9(48)	25.0(172)	110.7(43.7)	5.68	44.9(0.8)
236caE/HFC-134a						
5.0/95.0	44.5(307)	129.1(890)	121.1(49.5)	5.13	213.3(3.7)
95.0/5.0	7.2(50)	26.0(179)	111.8(44.3)	5.74	47.3(0.8)
236caE/HFC-143						
5.0/95.0	14.1(97)	44.2(305)	134.3(56.8)	5.60	82.1(1.4)
95.0/5.0	6.1(42)	22.5(155)	107.2(41.8)	5.49	38.9(0.7)
236caE/HFC-143a						
5.0/95.0	90.0(621)	232.8(1605)	160.3(71.3)	4.68	361.3(6.3)
95.0/5.0	9.6(66)	33.1(228)	123.6(50.9)	6.18	64.9(1.1)
236caE/HFC-152a						
5.0/95.0	43.5(300)	121.3(836)	143.5(61.9)	5.34	215.6(3.8)
95.0/5.0	7.9(54)	28.2(194)	115.9(46.6)	5.82	51.9(0.9)
236caE/HFC-161						
5.0/95.0	69.0(476)	180.6(1245)	142.5(61.4)	5.22	311.7(5.5)
95.0/5.0	10.1(70)	36.1(249)	126.8(52.7)	5.90	67.4(1.2
236caE/HFC-227ca						
5.0/95.0	30.5(210)	87.5(603)	99.0(37.2)	4.93	135.8(2.4)

	95.0/5.0	6.6(46)	23.8(164)	107.9(42.2)	5.67	42.7(0.8)
	236caE/HFC-227ea					
	5.0/95.0	29.8(205)	95.7(591)	98.9(37.2)	4.95	133.6(2.3)
	95.0/5.0	6.6(46)	23.7(163)	107.6(42.0)	5.67	42.5(0.7)
	236caE/HFC-236ca					
	5.0/95.0	11.3(78)	36.9(254)	104.4(40.2)	5.37	63.5(1.1)
	95.0/5.0	5.7(39)	21.4(147)	104.2(40.1)	5.44	36.5(0.6)
	236caE/HFC-236cb					
	5.0/95.0	15.5(107)	47.9(330)	100.9(38.3)	5.25	80.4(1.4)
	95.0/5.0	5.8(40)	21.7(149)	104.4(40.2)	5.46	37.2(0.7)
	236caE/HFC-236fa					
	5.0/95.0	17.3(119)	52.8(364)	100.2(37.9)	5.21	87.9(1.5)
	95.0/5.0	6.0(41)	22.2(153)	105.1(40.6)	5.50	38.3(0.7)
	236caE/HFC-245cb					
	5.0/95.0	29.8(205)	84.4(582)	100.1(37.8)	4.96	132.8(2.3)
	95.0/5.0	6.4(44)	23.4(161)	106.8(41.6)	5.59	41.2(0.7)
	236caE/HFC-245ea					
	5.0/95.0	6.1(42)	21.9(151)	112.9(44.9)	5.53	38.8(0.7)
	95.0/5.0	5.5(38)	20.7(143)	104.1(40.1)	5.42	35.2(0.6)
	236caE/HFC-245fa					
	5.0/95.0	9.7(67)	32.3(223)	107.0(41.7)	5.38	55.9(1.0)
	95.0/5.0	5.7(39)	21.2(146)	104.1(40.1)	5.43	36.2(0.6)
	236caE/HFC-254ca					
	5.0/95.0	6.0(41)	21.0(145)	111.3(44.1)	5.54	37.3(0.7)
	95.0/5.0	5.5(38)	20.6(142)	104.1(40.1)	5.43	35.2(0.6)
	236caE/HFC-254cb					
	5.0/95.0	16.0(111)	48.8(336)	107.5(41.9)	5.37	84.8(1.5)
	95.0/5.0	6.0(41)	22.1(152)	105.3(40.7)	5.47	38.0(0.7)
	236caE/HFC-254eb					
	5.0/95.0	16.3(113)	49.6(342)	107.5(41.9)	5.37	86.1(1.5)
	95.0/5.0	6.0(41)	22.1(153)	105.3(40.7)	5.47	38.2(0.7)
	236caE/HFC-263ca					
	5.0/95.0	8.3(57)	27.8(187)	112.4(44.7)	5.53	48.8(0.9)
	95.0/5.0	5.7(39)	21.1(145)	104.4(40.2)	5.44	36.1(0.6)
	236caE/HFC-263fb					

	5.0/95.0	26.0(179)	74.5(514)	108.5(42.5)	5.26	126.3(2.2)
	95.0/5.0	6.5(45)	23.6(163)	107.5(41.9)	5.57	41.5(0.7)
	236caE/HFC-272ca					
	5.0/95.0	16.7(115)	49.0(338)	112.2(44.6)	5.46	87.3(1.5)
	95.0/5.0	6.1(42)	22.5(155)	106.1(41.2)	5.49	39.0(0.7)
	236caE/HFC-272ea					
	5.0/95.0	9.6(66)	30.7(211)	117.9(47.7)	5.68	57.1(1.0)
	95.0/5.0	5.8(40)	21.6(149)	105.4(40.8)	5.44	37.0(0.7)
	236caE/HFC-272fb					
	5.0/95.0	12.2(84)	38.9(268)	117.5(47.5)	5.48	69.7(1.2)
	95.0/5.0	6.0(41)	22.1(152)	105.8(41.0)	5.46	38.0(0.7)
	236caE/HFC-281ea					
	5.0/95.0	23.2(160)	66.2(456)	117.8(47.7)	5.46	118.4(2.1)
	95.0/5.0	6.8(47)	24.4(169)	109.1(42.8)	5.58	43.2(0.8)
	236caE/HFC-281fa					
	5.0/95.0	18.2(125)	54.5(376)	117.5(47.5)	5.51	97.4(1.7)
	95.0/5.0	6.5(45)	23.4(163)	107.9(42.2)	5.53	41.3(0.7)
	236eaE$\beta\gamma$/HFC-125					
	5.0/95.0	93.0(641)	245.9(1695)	125.0(51.7)	4.39	338.5(5.9)
	95.0/5.0	10.4(72)	35.5(245)	116.6(47.0)	6.00	67.6(1.2)
	236eaE$\beta\gamma$/HFC-134					
	5.0/95.0	36.1(249)	104.5(721)	127.2(52.9)	5.35	183.1(3.2)
	95.0/5.0	8.3(58)	29.5(204)	108.7(42.6)	5.60	52.3(0.9)
	236eaE$\beta\gamma$/HFC-134a					
	5.0/95.0	45.5(314)	130.6(900)	119.7(48.7)	5.16	217.2(3.8)
	95.0/5.0	8.6(59)	30.6(211)	109.5(43.1)	5.65	54.3(1.0)
	236eaE$\beta\gamma$/HFC-143					
	5.0/95.0	14.3(97)	44.6(307)	134.4(56.9)	5.56	82.2(1.4)
	95.0/5.0	7.4(51)	26.6(1840	105.5(40.8)	5.43	45.8(0.8)
	236eaE$\beta\gamma$/HFC-143a					
	5.0/95.0	90.0(621)	232.8(1605)	160.3(71.3)	4.68	361.3(6.3)
	95.0/5.0	9.6(66)	32.8(226)	123.3(50.7)	6.23	65.1(1.1)
	236eaE$\beta\gamma$/HFC-152a					
	5.0/95.0	44.3(305)	122.5(844)	142.1(61.2)	5.38	219.0(3.8)
	95.0/5.0	9.5(65)	32.8(226)	113.6(45.3)	5.72	59.7(1.0)

236eaEβγ/HFC-161					
5.0/95.0	69.6(480)	181.5(1251)	141.7(60.9)	5.23	313.9(5.5)
95.0/5.0	11.7(81)	39.8(274)	121.8(49.9)	5.91	75.0(1.3)
236eaEβγ/HFC-227ca					
5.0/95.0	30.9(213)	88.3(609)	102.1(38.9)	4.88	135.9(2.4)
95.0/5.0	7.9(54)	27.9(193)	105.6(40.9)	5.57	49.2(0.9)
236eaEβγ/HFC-227ea					
5.0/95.0	30.3(209)	86.5(596)	102.0(38.9)	4.90	133.7(2.3)
95.0/5.0	7.9(54)	27.9(192)	105.5(40.8)	5.50	48.9(0.9)
236eaEβγ/HFC-236ca					
5.0/95.0	11.4(79)	37.3(257)	104.3(40.2)	5.32	63.6(1.1)
95.0/5.0	7.0(48)	25.7(177)	103.2(39.6)	5.32	42.9(0.8)
236eaEβγ/HFC-236cb					
5.0/95.0	15.9(110)	48.9(337)	100.0(37.8)	5.24	81.8(1.4)
95.0/5.0	7.2(50)	26.1(180)	103.2(39.6)	5.42	44.7(0.8)
236eaEβγ/HFC-236fa					
5.0/95.0	17.6(121)	53.3(368)	104.1(40.1)	5.16	88.1(1.6)
95.0/5.0	7.3(51)	26.4(182)	103.6(39.8)	5.42	45.3(0.8)
236eaEβγ/HFC-245ca					
5.0/95.0	6.2(43)	21.9(151)	109.0(42.8)	5.50	38.6(0.7)
95.0/5.0	6.8(47)	24.7(170)	102.8(39.3)	5.39	41.9(0.7)
236eaEβγ/HFC-245cb					
5.0/95.0	30.3(209)	85.2(587)	99.8(37.7)	4.96	134.3(2.4)
95.0/5.0	7.7(53)	27.5(190)	104.7(40.4)	5.50	47.9(0.8)
236eaEβγ/HFC-245ea					
5.0/95.0	6.2(42)	22.1(152)	112.9(44.9)	5.53	39.0(0.7)
95.0/5.0	6.8(47)	24.7(170)	103.0(39.4)	5.39	41.9(0.7)
236eaEβγ/HFC-245fa					
5.0/95.0	9.8(68)	32.5(224)	106.6(41.4)	5.41	56.5(1.0)
95.0/5.0	6.9(48)	25.3(175)	103.0(39.4)	5.36	42.8(0.8)
236eaEβγ/HFC-254ca					
5.0/95.0	6.0(41)	21.1(146)	111.3(44.1)	5.53	37.5(0.7)
95.0/5.0	6.8(47)	24.6(170)	103.0(39.4)	5.39	41.9(0.7)

236eaEβγ/HFC-254cb						
5.0/95.0	16.2(112)	49.1(338)	107.0(41.7)	5.38	85.6(1.5)
95.0/5.0	8.2(57)	26.2(181)	103.0(39.4)	6.04	50.9(0.9)
236eaEβγ/HFC-254eb						
5.0/95.0	16.5(114)	49.9(344)	106.9(41.6)	5.38	86.8(1.5)
95.0/5.0	7.3(50)	26.3(181)	103.8(39.9)	5.42	45.0(0.8)
236eaEβγ/HFC-263ca						
5.0/95.0	8.3(57)	27.3(188)	112.2(44.6)	5.54	49.1(0.9)
95.0/5.0	6.9(48)	25.1(173)	103.2(39.6)	5.39	42.7(0.8)
236eaEβγ/HFC-263fb						
5.0/95.0	26.3(181)	75.0(517)	107.8(42.1)	5.27	127.6(2.2)
95.0/5.0	7.8(54)	27.8(192)	105.5(40.8)	5.49	48.2(0.8)
236eaEβγ/HFC-272ca						
5.0/95.0	16.8(116)	49.3(340)	111.6(44.2)	5.47	88.2(1.5)
95.0/5.0	7.5(52)	26.8(184)	104.6(40.3)	5.43	46.0(0.8)
236eaEβγ/HFC-272ea						
5.0/95.0	9.5(66)	31.1(214)	118.6(48.1)	5.57	56.6(1.0)
95.0/5.0	7.1(49)	25.6(176)	103.9(39.9)	5.41	43.8(0.8)
236eaEβγ/HFC-272fb						
5.0/95.0	12.4(85)	39.1(269)	117.1(47.3)	5.51	70.4(1.2)
95.0/5.0	7.3(50)	26.2(181)	104.3(40.2)	5.41	44.8(0.8)
236eaEβγ/HFC-281ea						
5.0/95.0	23.4(162)	66.6(459)	117.3(47.4)	5.46	119.2(2.1)
95.0/5.0	8.1(56)	28.6(197)	107.0(41.7)	5.50	49.9(0.9)
236eaEβγ/HFC-281fa						
5.0/95.0	18.3(126)	54.3(375)	117.4(47.4)	5.49	98.0(1.7)
95.0/5.0	7.8(54)	27.8(192)	106.0(41.1)	5.46	48.0(0.8)
236faE/HFC-125						
5.0/95.0	99.6(687)	252.9(1743)	119.9(48.8)	4.49	354.1(6.2)
95.0/5.0	17.4(120)	54.6(377)	103.8(39.9)	5.51	95.4(1.7)
236faE/HFC-134						
5.0/95.0	37.6(259)	108.1(745)	125.3(51.8)	5.33	188.4(3.3)
95.0/5.0	15.8(109)	50.6(349)	100.6(38.1)	5.29	85.0(1.5)

236faE/HFC-134a						
	5.0/95.0	48.2(332)	135.5(934)	116.5 (46.9)	5.19	226.2(4.0)
	95.0/5.0	16.2(112)	51.7(356)	101.1 (38.4)	5.33	87.4(1.5)
236faE/HFC-143						
	5.0/95.0	14.5(100)	45.5(314)	133.6 (56.4)	5.58	84.1(1.5)
	95.0/5.0	14.5(100)	46.6(321)	103.5 (39.7)	5.17	76.7(1.3)
236faE/HFC-143a						
	5.0/95.0	96.7(667)	241.0(1662)	152.6 (67.0)	4.81	382.2(6.7)
	95.0/5.0	18.3(126)	56.9(392)	106.6 (41.4)	5.58	101.1(1.8)
236faE/HFC-152a						
	5.0/95.0	45.7(315)	125.1(863)	140.1 (60.1)	5.39	224.3(3.9)
	95.0/5.0	17.1(118)	54.2(374)	103.9 (39.9)	5.37	92.6(1.6)
236faE/HFC-161						
	5.0/95.0	72.2(498)	185.7(1280)	138.9 (59.4)	5.27	322.7(5.7)
	95.0/5.0	20.6(142)	63.3(436)	110.6 (43.7)	5.65	113.9(2.0)
236faE/HFC-227ca						
	5.0/95.0	31.9(220)	90.1(621)	101.5 (30.6)	4.87	138.3(2.4)
	95.0/5.0	14.8(1020	47.7(329)	101.5 (38.6)	5.16	78.0(1.4)
236faE/HFC-227ea						
	5.0/95.0	31.1(215)	88.3(609)	101.6 (38.7)	4.88	135.8(2.4)
	95.0/5.0	14.7(101)	47.6(328)	101.5 (38.6)	5.16	77.8(1.4)
236faE/HFC-236ca						
	5.0/95.0	11.8(81)	38.1(263)	103.7 (39.8)	5.35	65.4(1.1)
	95.0/5.0	13.8(95)	45.0(310)	102.1 (38.9)	5.12	73.1(1.3)
236faE/HFC-236cb						
	5.0/95.0	16.3(112)	49.8(343)	104.2 (40.1)	5.17	82.5(1.4)
	95.0/5.0	14.1(97)	45.8(316)	101.8 (38.8)	5.12	74.3(1.3)
236faE/HFC-236fa						
	5.0/95.0	18.0(124)	54.3(375)	104.0 (40.0)	5.13	89.1(1.6)
	95.0/5.0	14.2(98)	46.0(317)	101.8 (38.8)	5.12	74.6(1.3)
236faE/HFC-245ca						
	5.0/95.0	6.4(44)	22.5(155)	109.1 (42.8)	5.51	39.7(0.7)
	95.0/5.0	13.2(91)	43.3(299)	102.3 (39.1)	5.18	71.1(1.2)

236faE/HFC-245cb						
5.0/95.0	31.6(218)	87.4(603)	109.0 (42.8)	4.84	134.4(2.4)
95.0/5.0	14.8(102)	47.5(328)	106.5 (41.4)	5.09	76.9(1.4)
236faE/HFC-245ea						
5.0/95.0	6.4(44)	22.7(157)	113.1 (45.1)	5.54	40.3(0.7)
95.0/5.0	13.3(92)	43.6(301)	102.4 (39.1)	5.17	71.6(1.3)
236faE/HFC-245fa						
5.0/95.0	10.1(70)	33.3(230)	106.3 (41.3)	5.40	57.9(1.0)
95.0/5.0	13.7(94)	44.6(308)	102.0 (38.9)	5.16	72.9(1.3)
236faE/HFC-254ca						
5.0/95.0	6.2(43)	21.6(149)	111.5 (44.2)	5.55	38.6(0.7)
95.0/5.0	13.2(91)	43.3(299)	102.6 (39.2)	5.17	70.9(1.2)
236faE/HFC-254cb						
5.0/95.0	16.6(114)	50.2(346)	106.1 (41.2)	5.37	87.1(1.5)
95.0/5.0	14.1(97)	45.8(316)	102.2 (39.0)	5.14	74.6(1.3)
236faE/HFC-254eb						
5.0/95.0	16.9(117)	51.0(352)	106.0 (41.1)	5.36	88.4(1.6)
95.0/5.0	14.1(97)	45.9(316)	102.3 (39.1)	5.13	74.7(1.3)
236faE/HFC-263ca						
5.0/95.0	8.5(59)	28.0(193)	112.5 (44.7)	5.49	49.9(0.9)
95.0/5.0	13.5(93)	43.9(303)	102.6 (39.2)	5.17	72.0(1.3)
236faE/HFC-263fb						
5.0/95.0	27.0(186)	76.9(530)	106.6 (41.4)	5.22	129.2(2.3)
95.0/5.0	14.8(102)	47.6(328)	102.3 (39.1)	5.16	77.8(1.4)
236faE/HFC-272ca						
5.0/95.0	17.2(119)	50.1(345)	110.8 (43.8)	5.47	89.6(1.6)
95.0/5.0	14.3(99)	46.1(318)	102.8 (39.3)	5.14	75.3(1.3)
236faE/HFC-272ea						
5.0/95.0	9.7(67)	31.8(219)	118.9 (48.3)	5.52	57.4(1.0)
95.0/5.0	13.8(95)	44.8(309)	103.2 (39.6)	5.15	73.3(1.3)
236faE/HFC-272fb						
5.0/95.0	12.6(87)	39.8(274)	116.6 (47.0)	5.52	71.8(1.3)
95.0/5.0	14.1(97)	45.5(314)	103.0 (39.4)	5.15	74.6(1.3)

236faE/HFC-281ea					
5.0/95.0	23.9(165)	67.6(466)	116.3 (48.0)	5.45	120.9(2.1)
95.0/5.0	15.2(105)	48.4(334)	103.3 (39.6)	5.19	79.9(1.4)
236faE/HFC-281fa					
5.0/95.0	18.7(129)	55.1(380)	116.6 (47.0)	5.50	99.4(1.7)
95.0/5.0	14.8(102)	47.4(327)	103.3 (39.6)	5.18	78.0(1.4)
245faE$\beta\gamma$/HFC-125					
5.0/95.0	88.9(613)	240.9(1661)	128.2 (53.4)	4.33	328.4(5.8)
95.0/5.0	8.9(61)	30.1(208)	121.1 (49.5)	6.35	60.9(1.1)
245faE$\beta\gamma$/HFC-134					
5.0/95.0	34.6(239)	101.7(701)	129.6 (54.2)	5.32	177.2(3.1)
95.0/5.0	6.6(46)	23.9(165)	111.6 (44.2)	5.68	43.0(0.8)
245faE$\beta\gamma$/HFC-134a					
5.0/95.0	43.4(299)	127.2(877)	122.3 (50.2)	5.11	209.7(3.7)
95.0/5.0	6.9(48)	24.8(171)	112.7 (44.8)	5.75	45.2(0.8)
245faE$\beta\gamma$/HFC-143					
5.0/95.0	13.9(96)	44.3(305)	135.4 (57.4)	5.50	80.7(1.4)
95.0/5.0	5.9(41)	21.7(150)	108.6 (42.6)	5.51	37.9(0.7)
245faE$\beta\gamma$/HFC-143a					
5.0/95.0	89.2(615)	231.5(1596)	161.1 (71.7)	4.66	359.0(6.3)
95.0/5.0	9.4(65)	31.9(220)	124.7 (51.5)	6.31	64.2(1.1)
245faE$\beta\gamma$/HFC-152a					
5.0/95.0	42.8(295)	120.1(828)	144.4 (62.4)	5.33	213.0(3.7)
95.0/5.0	7.5(52)	26.7(184)	116.5 (46.9)	5.81	49.2(0.9)
245faE$\beta\gamma$/HFC-161					
5.0/95.0	67.9(468)	178.9(1233)	143.5 (61.9)	5.20	307.8(5.4)
95.0/5.0	9.6(66)	33.1(228)	126.0 (52.2)	6.06	64.3(1.1)
245faE$\beta\gamma$/HFC-227ca					
5.0/95.0	30.5(210)	87.6(604)	98.9 (37.2)	4.93	136.0(2.4)
95.0/5.0	6.5(45)	23.4(161)	109.9 (43.3)	5.76	42.7(0.8)
245faE$\beta\gamma$/HFC-227ea					
5.0/95.0	29.9(206)	85.8(592)	98.8 (37.1)	4.95	133.9(2.4)
95.0/5.0	6.5(45)	23.3(161)	109.8 (43.2)	5.74	42.5(0.7)
245faE$\beta\gamma$/HFC-236ca					
5.0/95.0	11.2(77)	37.1(256)	104.8 (40.4)	5.29	62.9(1.1)

95.0/5.0	5.6(39)	20.9(144)	106.0 (41.1)	5.47	36.1(0.6)
245faEβγ/HFC-236cb					
5.0/95.0	15.7(108)	48.4(334)	100.2 (37.9)	5.25	81.3(1.4)
95.0/5.0	5.8(40)	21.5(148)	106.7 (41.5)	5.52	37.4(0.7)
245faEβγ/HFC-236fa					
5.0/95.0	17.3(119)	52.6(363)	100.3 (37.9)	5.22	87.7(1.5)
95.0/5.0	5.8(40)	21.6(149)	106.9 (41.6)	5.52	37.6(0.7)
245faEβγ/HFC-245ca					
5.0/95.0	6.2(43)	21.8(150)	109.0 (42.8)	5.51	38.4(0.7)
95.0/5.0	5.4(37)	20.2(139)	105.7 (40.9)	5.45	34.7(0.6)
245faEβγ/HFC-245cb					
5.0/95.0	29.7(205)	84.0(579)	100.1 (37.8)	4.97	132.6(2.3)
95.0/5.0	6.3(43)	22.8(157)	108.5 (42.5)	5.64	40.7(0.7)
245faEβγ/HFC-245ea					
5.0/95.0	6.1(42)	21.9(151)	112.9 (44.9)	5.53	38.8(0.7)
95.0/5.0	5.4(37)	20.2(139)	105.8 (41.0)	5.45	34.7(0.6)
245faEβγ/HFC-245fa					
5.0/95.0	9.7(67)	32.3(223)	107.0 (41.7)	5.38	55.9(1.0)
95.0/5.0	5.5(38)	20.9(144)	106.4 (41.3)	5.37	35.2(0.6)
245faEβγ/HFC-254ca					
5.0/95.0	6.0(41)	21.0(1450	111.3 (44.1)	5.54	37.3(0.7)
95.0/5.0	5.4(37)	20.2(139)	105.7 (40.9)	5.46	34.7(0.6)
245faEβγ/HFC-254cb					
5.0/95.0	16.0(110)	48.7(336)	107.6 (42.0)	5.37	84.6(1.5)
95.0/5.0	5.8(40)	21.5(148)	107.0 (41.7)	5.51	37.5(0.7)
245faEβγ/HFC-254eb					
5.0/95.0	16.3(112)	49.4(341)	107.4 (41.9)	5.38	86.0(1.5)
95.0/5.0	5.8(40)	21.6(149)	107.1 (41.7)	5.51	37.6(0.7)
245faEβγ/HFC-263ca					
5.0/95.0	8.3(57)	27.2(188)	112.5 (44.7)	5.50	48.7(0.9)
95.0/5.0	5.5(38)	20.7(143)	106.4 (41.3)	5.41	35.2(0.6)
245faEβγ/HFC-263fb					
5.0/95.0	25.9(179)	74.2(512)	108.7 (42.6)	5.26	126.0(2.2)
95.0/5.0	6.3(43)	22.9(158)	109.1 (42.8)	5.62	40.8(0.7)
245faEβγ/HFC-272ca					

	5.0/95.0	16.4(113)	49.4(341)	113.0 (45.0)	5.31	85.7(1.5)
	95.0/5.0	6.0(41)	22.0(152)	107.9 (42.2)	5.53	38.5(0.7)
	245faEβγ/HFC-272ea					
	5.0/95.0	9.4(65)	30.9(213)	118.9 (48.3)	5.55	56.0(1.0)
	95.0/5.0	5.6(39)	21.2(146)	107.5 (41.9)	5.40	35.7(0.6)
	245faEβγ/HFC-272fb					
	5.0/95.0	12.2(84)	38.9(268)	117.8 (47.7)	5.46	69.4(1.2)
	95.0/5.0	5.8(40)	21.5(148)	107.3 (41.8)	5.50	37.2(0.7)
	245faEβγ/HFC-281ea					
	5.0/95.0	23.1(159)	65.9(454)	118.1 (47.8)	5.45	117.8(2.1)
	95.0/5.0	6.5(45)	23.6(163)	110.5 (43.6)	5.60	42.0(0.7)
	245faEβγ/HFC-281fa					
	5.0/95.0	18.1(125)	53.9(372)	117.9 (47.7)	5.48	97.0(1.7)
	95.0/5.0	6.3(43)	22.9(158)	109.3 (42.9)	5.55	40.2(0.7)

EXAMPLE 5

The following table shows the refrigerant performance of various compositions. The data are based on the following conditions.

Evaporator temperature 10.0°F (-12.2°C)
Condenser temperature 90.0°F (32.2°C)
Return gas temperature 30.0°F (-1.1°C)
Compressor efficiency is 75%.

TABLE 6

Refrig. Comp.	Evap. Press. Psia (kPa)	Cond. Press. Psia (kPa)	Comp. Dis. Temp. °F (°C)	COP	Capacity BTU/min (kw)
HCFC-22	47.9(330)	183.6(1266)	179.1(81.7)	3.62	217.7(3.8)
116E/HFC-32					
88/12	85.4(589)	312.7(2157)	127.7(53.2)	3.01	283.6(5.0)
75.2/24.8	79.4(547)	296.6(2046)	135.7(57.6)	3.24	294.9(5.2)
50/50	76.2(525)	289.2(1995)	149.0(65.0)	3.39	308.3(5.4)
116E/HFC-41*					
84/16	39.6(273)	206.2(1422)	127.4(53.0)	3.05	182.9(3.2)

	58.6/41.4	52.8(364)	219.6(1515)	149.6(65.3)	3.32	237.7(4.2)
	30/70	68.9(475)	274.0(1890)	179.7(82.1)	3.15	294.4(5.2)

*Condenser temp. 50.0°F, Evaporator temp. -30.0°F, and Return gas temp. -10.0°F

116E/HFC-125					
99/1*	82.2(567)	304.0(2097)	101.4(38.6)	2.87	254.9(4.5)
86.0/14.0	96.5(665)	338.9(2338)	121.4(49.7)	2.73	273.5(4.8)
1/99	64.8(447)	237.2(750)	132.5(55.8)	3.28	240.1(4.2)
5.0/95.0	66.5(458)	242.1(1669)	131.7(55.4)	3.27	243.8(4.3)
95.0/5.0	98.5(679)	319.1(2200)	113.8(45.4)	2.21	211.7(3.7)

*Condenser temp. 80.0°F, Evaporator temp. 0.0°F, and Return gas temp. 10.0°F

116E/HFC-134					
90.2/9.8	103.9 (716)	319.9 (2206)	112.1 (44.5)	3.24	314.2 (5.5)

116E/HFC-134a					
99/1*	82.8(571)	306.1(2112)	110.2(43.4)	2.75	247.3(4.4)
90.0/10.0	103.0(710)	332.4(2293)	115.0(46.1)	3.00	299.7(5.3)
53/47	63.1(435)	265.2(1829)	121.2(49.6)	2.78	215.4(3.8)
5.0/95.0	34.9(241)	138.2(953)	129.7(54.3)	4.04	172.6(3.0)
95.0/5.0	101.9(702)	356.2(2456)	120.7(49.3)	2.62	274.5(4.8)

*Condenser temp. 80°F, Evaporator temp. 0.0°F, and Return gas temp. 20.0°F

116E/HFC-143					
99/1	98.2(677)	345.7(2385)	120.2(49.0)	2.66	270.3(4.8)
94.9/5.1	43.3(298)	241.2(1664)	139.7(59.8)	2.38	155.0(2.7)
60/40	27.3(188)	112.9(779)	131.0(55.0)	4.28	169.5(3.0)

116E/HFC-143a					
99/1*	82.2(567)	304.1(2098)	110.5(43.6)	2.76	247.5(4.4)
94.8/5.2*	81.8(564)	301.6(2081)	112.8(44.9)	2.81	250.8(4.4)
40/60	75.9(523)	270.0(1863)	155.6(68.7)	3.29	283.4(5.0)
5.0/95.0	62.4(430)	226.2(1559)	182.0(83.3)	3.42	255.2(4.5)
95.0/5.0	98.7(681)	318.9(2199)	115.6(46.4)	2.32	223.7(3.9)

*Condenser temp. 80.0°F, Evaporator temp. 0.0°F, and Return gas temp. 20.0°F

116E/HFC-152a					
99/1	100.2(691)	315.8(2179)	111.6(44.2)	3.19	303.7(5.3)
92.1/7.9	102.9(710)	320.1(2208)	114.7(45.9)	3.23	314.4(5.5)
60/40	60.0(414)	250.1(1725)	148.5(64.7)	3.39	256.5(4.5)
5.0/95.0	32.4(224)	123.9(854)	161.5(71.9)	4.16	167.0(2.9)
95.0/5.0	102.6(707)	335.9(2316)	117.4(47.4)	2.76	278.2(4.9)

116E/HFC-161*					
99/1	57.4(396)	243.5(1680)	102.4(39.1)	2.92	206.7(3.6)
87.3/12.7	32.4(223)	149.6(1032)	91.5(33.1)	3.79	166.8(2.9)
60/40	22.1(152)	126.1(870)	151.7(66.5)	3.33	119.3(2.1)

*Condenser temp. 70.0°F, Evaporator temp. -10.0°F, and Return gas temp. 10.0°F

116E/HFC-227ca					
5.0/95.0	20.9(143)	89.9(620)	108.0(42.2)	3.69	97.7(3.5)
95.0/5.0	92.3(636)	331.4(2285)	119.9(48.8)	2.67	259.8(4.6)
116E/HFC-227ea					
5.0/95.0	16.7(115)	78.3(540)	104.4(40.2)	3.67	82.2(1.4)
95.0/5.0	92.3(636)	333.0(2296)	119.9(48.8)	2.66	259.2(4.6)
116E/HFC-236ca					
5.0/95.0*	16.2 (112)	72.9 (503)	149.7 (65.4)	3.93	84.2 (1.5)
95.0/5.0	70.9 (489)	301.7 (2080)	127.3 (52.9)	2.71	233.8 (4.1)

* = Condenser temp. of 130°F, evaporator temp. of 45°F, and return gas temp. of 65°F

116E/HFC-236cb					
5.0/95.0	11.5(79)	53.1(366)	110.8(43.8)	3.97	62.0(1.1)
95.0/5.0	86.0(593)	321.4(2216)	121.4(49.7)	2.66	249.2(4.4)
116E/HFC-236ea					
5.0/95.0	10.4(72)	48.7(335)	114.0(45.6)	4.20	60.1(1.1)
95.0/5.0	85.4(589)	321.7(2218)	122.1(50.1)	2.64	247.8(4.4)
116E/HFC-236fa					
5.0/95.0	12.5(86)	57.1(394)	110.5(43.6)	3.92	65.8(1.2)
95.0/5.0	87.2(601)	322.8(2226)	121.0(49.4)	2.67	251.6(4.4)
116E/HFC-245ca*					
5.0/95.0	9.9 (68)	47.0 (324)	153.9 (67.7)	4.30	59.1 (1.0)
95.0/5.0	54.0 (372)	279.2 (1925)	136.3 (57.9)	2.58	195.5 (3.4)

* = Condenser temp. of 130°F, evaporator temp. of 45°F, and return gas temp. of 65°F

116E/HFC-245cb					
5.0/95.0	21.3(146)	88.3(609)	104.3(40.2)	3.63	96.0(1.7)
95.0/5.0	93.2(642)	331.4(2285)	119.1(48.4)	2.69	262.0(4.6)
116E/HFC-245ea					
5.0/95.0*	9.9 (68)	47.8 (330)	157.9 (69.9)	4.35	60.8 (1.1)
95.0/5.0	37.3 (257)	318.6 (2196)	165.8 (74.3)	1.61	112.2 (2.0)

* = Condenser temp. of 130°F, evaporator temp. of 45°F, and return gas temp. of 65°F

116E/HFC-245fa

5.0/95.0*	14.1 (97)	64.1 (442)	152.5 (66.9)	4.03	76.2 (1.3)
95.0/5.0	65.4 (451)	292.5 (2017)	129.6 (54.2)	2.70	223.6 (3.9)

* = Condenser temp. of 130°F, evaporator temp. of 45°F, and return gas temp. of 65°F

116E/HFC-254ca

5.0/95.0*	9.4 (65)	44.7 (308)	156.9 (69.4)	4.32	56.8 (1.0)
95.0/5.0	50.1 (345)	273.7 (1887)	139.2 (59.6)	2.54	185.1 (3.3)

* = Condenser temp. of 130°F, evaporator temp. of 45°F, and return gas temp. of 65°F

116E/HFC-254cb

5.0/95.0	12.1(83)	53.7(370)	118.9(48.3)	4.14	67.0(1.2)
95.0/5.0	86.1(594)	318.7(2197)	121.2(49.6)	2.68	250.5(4.4)

116E/HFC-263ca

5.0/95.0	9.4(65)	44.8(309)	114.8(46.0)	4.28	56.0(1.0)
95.0/5.0	83.1(573)	317.9(2192)	122.6(50.3)	2.62	242.9(4.3)

116E/HFC-263fb

5.0/95.0	18.1(125)	76.3(526)	120.3(49.1)	3.89	90.4(1.6)
95.0/5.0	91.0(628)	326.1(2248)	120.0(48.9	2.71	260.4(4.6)

116E/HFC-272ca

5.0/95.0*	21.2 (146)	85.6 (590)	159.4 (70.8)	3.85	101.7 (1.8)
95.0/5.0	68.7 (474)	284.5 (1962)	125.8 (52.1)	2.89	237.4 (4.2)

* = Condenser temp. of 130°F, evaporator temp. of 45°F, and return gas temp. of 65°F

116E/HFC-272ea

5.0/95.0*	13.0 (90)	58.3 (402)	167.4 (75.2)	4.11	72.6 (1.3)
95.0/5.0	54.7 (377)	222.1 (1531)	120.4 (49.1)	3.46	228.0 (4.0)

* = Condenser temp. of 130°F, evaporator temp. of 45°F, and return gas temp. of 65°F

116E/HFC-272fb

5.0/95.0*	16.2 (112)	70.8 (488)	166.3 (74.6)	3.99	85.8 (1.5)
95.0/5.0+	49.8 (343)	236.8 (1633)	120.5 (49.2)	2.90	193.4 (3.4)

* = Condenser temp. of 130°F, evaporator temp. of 45°F, and return gas temp. of 65°F
\+ = Return gas temp. 20°F

116E/HFC-281ea

	5.0/95.0	16.7(115)	68.0(469)	132.1(55.6)	4.17	88.8(1.6)
	95.0/5.0	89.7(618)	287.7(1983)	103.1(39.5)	3.08	266.6(4.7)
	116E/HFC-281fa					
	5.0/95.0	14.0(96)	57.7(398)	129.9(54.4)	4.39	78.9(1.4)
	95.0/5.0	85.8(591)	273.8(1887)	110.5(43.6)	2.99	249.5(4.4)

EXAMPLE 6

Refrigerant Performance

The following table shows the refrigerant performance of various compositions. Except where indicated, the data are based on the following conditions.

Evaporator temperature	40.0°F (4.4°C)
Condenser temperature	100.0°F (37.8°C)
Subcool temperature	0°F (-17.8°C)
Return gas temperature	40.0°F (12.8°C)
Compressor efficiency is 75%.	

TABLE 7

Refrig. Comp.	Evap. Press. Psia (kPa)	Cond. Press. Psia (kPa)	Comp. Dis. Temp. °F (°C)	COP	Capacity BTU/min (kw)
236eaEβγ/HFC-245ca					
69.1/30.9	6.8 (47)	25.2 (174)	101.5 (38.6)	5.32	42.1 (0.7)
236caE/HFC-245ca					
16.1/83.9	6.1 (42)	23.3 (161)	108.3 (42.3)	5.41	39.6 (0.7)
236eaEβγ/HFC-356mff*					
96.9/3.1	6.8 (47)	25.2 (174)	113.4 (45.2)	5.11	40.4 (0.7)
*return gas temp. = 55.0°F (12.8°C)					
245faEβγ/HFC-356mff*					
4.4/95.6	6.5 (45)	23.2 (160)	108.5 (42.5)	5.04	36.8 (0.6)
*return gas temp. = 55.0°F (12.8°C)					

The following compounds have the indicated HGWPs (all HGWP values are relative to CFC-11 = 1.0). The HGWPs were estimated relative

to the HGWP of CFC-11 as follows:

HGWP = (IR abs (A) / IR abs. (CFC-11)) x
(t (A) / t (CFC-11)) x
(mass (CFC-11) / mass (A))

where A is the gas being analyzed;

IR abs. is the total infrared absorption cross section in the region of interest, that is, where H_2O and CO_2 do not absorb;

t = atmospheric lifetime; and

mass = atomic mass.

COMPOUND	HGWP
HFC-125	0.84
HFC-134	≈ 0.28
HFC-134a	0.28
HFC-143a	1.1
FC-218	>10
134E	≈ 0.1
143aE	≈ 0.2

A composition of a fluoroether and an HFC are prepared, and have the indicated HGWPs.

COMPOSITION (wt.%/wt/%)	HGWP
134E/HFC-125 (80.0/20.0)	0.25
134E/HFC-125 (46.0/54.0)	0.5
134E/HFC-134 (80.0/20.0)	0.14
134E/HFC-134a (80.0/20.0)	0.14
134E/HFC-143a (80.0/20.0)	0.3
143aE/HFC-125 (80.0/20.0)	0.33

	143aE/HFC-143a (80.0/20.0)	0.38
	143aE/HFC-125 (53.0/47.0)	0.5
	143aE/HFC-134 (80.0/20.0)	0.22
	143aE/HFC-134a (80.0/20.0)	0.22

The novel compositions of this invention, including the azeotropic or azeotrope-like compositions, may be used to produce refrigeration by condensing the compositions and thereafter evaporating the condensate in the vicinity of a body to be cooled. The novel compositions may also be used to produce heat by condensing the refrigerant in the vicinity of the body to be heated and thereafter evaporating the refrigerant.

In addition to refrigeration applications, the novel constant boiling or substantially constant boiling compositions of the invention are also useful as aerosol propellants, heat transfer media, gaseous dielectrics, fire extinguishing agents, expansion agents for polyolefins and polyurethanes and power cycle working fluids.

Additives such as lubricants, corrosion inhibitors, stabilizers, dyes and other appropriate materials may be added to the novel compositions of the invention for a variety of purposes provided they do not have an adverse influence on the composition for its intended application. Preferred lubricants include esters having a molecular weight of greater than 250.

CLAIMS

1. A refrigerant composition comprising

(a) a cyclic or acyclic hydrofluoroether of the formula $C_aF_bH_{2a+2-b}O$ wherein a=2 or 3 and b=3,4,6,7 or 8 and b=5 when a=3,

or $CF_3OCF_2OCF_3$ and

(b) a hydrofluorocarbon of the formula $C_nF_mH_{2n+2-m}$ wherein $1 \leq n \leq 4$ and $1 \leq m \leq 8$.

2. A refrigerant composition comprising 1 to 49 weight percent CHF_2OCF_3 and 51 to 99 weight percent of a hydrofluorocarbon of the formula $C_nF_mH_{2n+2-m}$ wherein $1 \leq n \leq 4$ and $1 \leq m \leq 8$.

3. An azeotropic or azeotrope-like composition comprising effective amounts of: 116E and HFC-32, HFC-41, HFC-125, HFC-134, HFC-134a, HFC-143, HFC-143a, HFC-152a or HFC-161; 125E and HFC-32, HFC-134, HFC-134a, HFC-143, HFC-152a or HFC-161; 134E and HFC-143, HFC-227ca, HFC-227ea, HFC-236ca, HFC-236cb, HFC-236ea, HFC-236fa, HFC-245cb, HFC-254cb, HFC-254eb, HFC-338mf or HFC-356mff; 134aE and HFC-143, HFC-227ca, HFC-227ea or HFC-245cb; 143aE and HFC-32, HFC-134, HFC-143a, HFC-152a, HFC-227ca, HFC-227ea or HFC-245cb; C216E and HFC-134, HFC-134a, HFC-143, HFC-152a, HFC-161or HFC-245cb; C-216E2 and HFC-32, HFC-134, HFC-134a, HFC-143, HFC-152a, HFC-161, and HFC-245cb; 218E and HFC-134, HFC-134a, HFC-143, HFC-152a, HFC-161 or HFC-263fb; 218E2 and HFC-134, HFC-134a, HFC-143, HFC-152a, HFC-161, HFC-236fa or HFC-263fb; C-225eE$\alpha\beta$ and HFC-143, HFC-236cb, HFC-236ea, and HFC-245cb; 227caE$\alpha\beta$ and HFC-32, HFC-143, HFC-245cb, HFC-272ca, HFC-281ea or HFC-281fa; 227caE$\beta\gamma$ and HFC-32, HFC-134, HFC-134a, HFC-143, HFC-152a, HFC-161, HFC-263fb, HFC-272ca, HFC-281ea or HFC-281fa; 227eaE and HFC-32, HFC-134, HFC-134a, HFC-143, HFC-152a, HFC-161, HFC-263fb, HFC-272ca, HFC-281ea or HFC-281fa; 236caE and HFC-143, HFC-245ca or HFC-254ca; C-234fE$\alpha\beta$ and HFC-245cb, HFC-245eb, HFC-356mff and HFC-356mmz; C-234fE$\beta\gamma$ and HFC-245ca, HFC-245cb, HFC-245ea, HFC-254ca or

HFC-356mmz; 236eaE$\beta\gamma$ and HFC-143, HFC-245ca, HFC-263ca, HFC-338mf, HFC-356mff or HFC-356mmz; 236faE and HFC-32, HFC-143, HFC-272ca, HFC-272fb or HFC-281fa; or 245faE$\beta\gamma$ and HFC-356mff or HFC-356mmz to form an azeotropic or azeotrope-like composition.

4. A composition comprising effective amounts of a first component and a second component, where the first component comprises a hydrofluorocarbon, and the second component comprises a hydrofluoroether and has a halocarbon global warming potential less than the halocarbon global warming potential of the first component, such that the composition has a halocarbon global warming potential lower than the halocarbon global warming potential of the first component.

INTERNATIONAL SEARCH REPORT

International Application No PCT/US 93/04614

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all)[6]

According to International Patent Classification (IPC) or to both National Classification and IPC

Int.Cl. 5 C09K5/04; C09K3/30; C08J9/14

II. FIELDS SEARCHED

Minimum Documentation Searched[7]

Classification System	Classification Symbols
Int.Cl. 5	C09K

Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched[8]

III. DOCUMENTS CONSIDERED TO BE RELEVANT[9]

Category[*]	Citation of Document,[11] with indication, where appropriate, of the relevant passages[12]	Relevant to Claim No.[13]
X	EP,A,0 385 737 (W.R.GRACE & CO.-CONN.) 5 September 1990 see page 2, line 1 - line 2 see page 4, line 18 - line 24 see claims 3-5,7-9	1,3
X	DATABASE WPI Week 9122, Derwent Publications Ltd., London, GB; & JP,A,3 093 890 (DAIKIN KOGYO KK) 18 April 1991 see abstract	1-3
X	DATABASE WPI Week 9122, Derwent Publications Ltd., London, GB; & JP,A,3 093 889 (DAIKIN KOGYO KK) 18 April 1991 see abstract	1-3

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[*] Special categories of cited documents :[10]

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

IV. CERTIFICATION

Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report
11 AUGUST 1993	25. 08. 93
International Searching Authority	**Signature of Authorized Officer**
EUROPEAN PATENT OFFICE	PUETZ C.

III. DOCUMENTS CONSIDERED TO BE RELEVANT (CONTINUED FROM THE SECOND SHEET)

Category °	Citation of Document, with indication, where appropriate, of the relevant passages	Relevant to Claim No.
X	DATABASE WPI Week 9122, Derwent Publications Ltd., London, GB; & JP,A,3 093 883 (DAIKIN KOGYO KK) 18 April 1991 see abstract	1-3
E	WO,A,9 311 201 (UNITED STATES ENVIRONMENTAL PROTECTION AGENCY) 10 June 1993 see page 3, line 2 - line 16; tables 3,4 see claims 1,3-7	1-3
X	DATABASE WPI Week 9122, Derwent Publications Ltd., London, GB; & JP,A,3 093 882 (DAIKIN KOGYO KK) 18 April 1991 see abstract	1,3
A	EP,A,0 127 365 (IMPERIAL CHEMICAL INDUSTRIES) 5 December 1984 see page 2, line 15 - page 6, line 2 see examples 1,4,5,7	1,3
A	DATABASE WPI Week 9221, Derwent Publications Ltd., London, GB; & JP,A,4 110 386 (DAIKIN KOGYO KK) 10 April 1992 see abstract	1

ANNEX TO THE INTERNATIONAL SEARCH REPORT ON INTERNATIONAL PATENT APPLICATION NO.

US 9304614
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This annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report. The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information. 11/08/93

Patent document cited in search report	Publication date	Patent family member(s)		Publication date
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		AU-B-	614215	22-08-91
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